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OCTOBER 21, 1985

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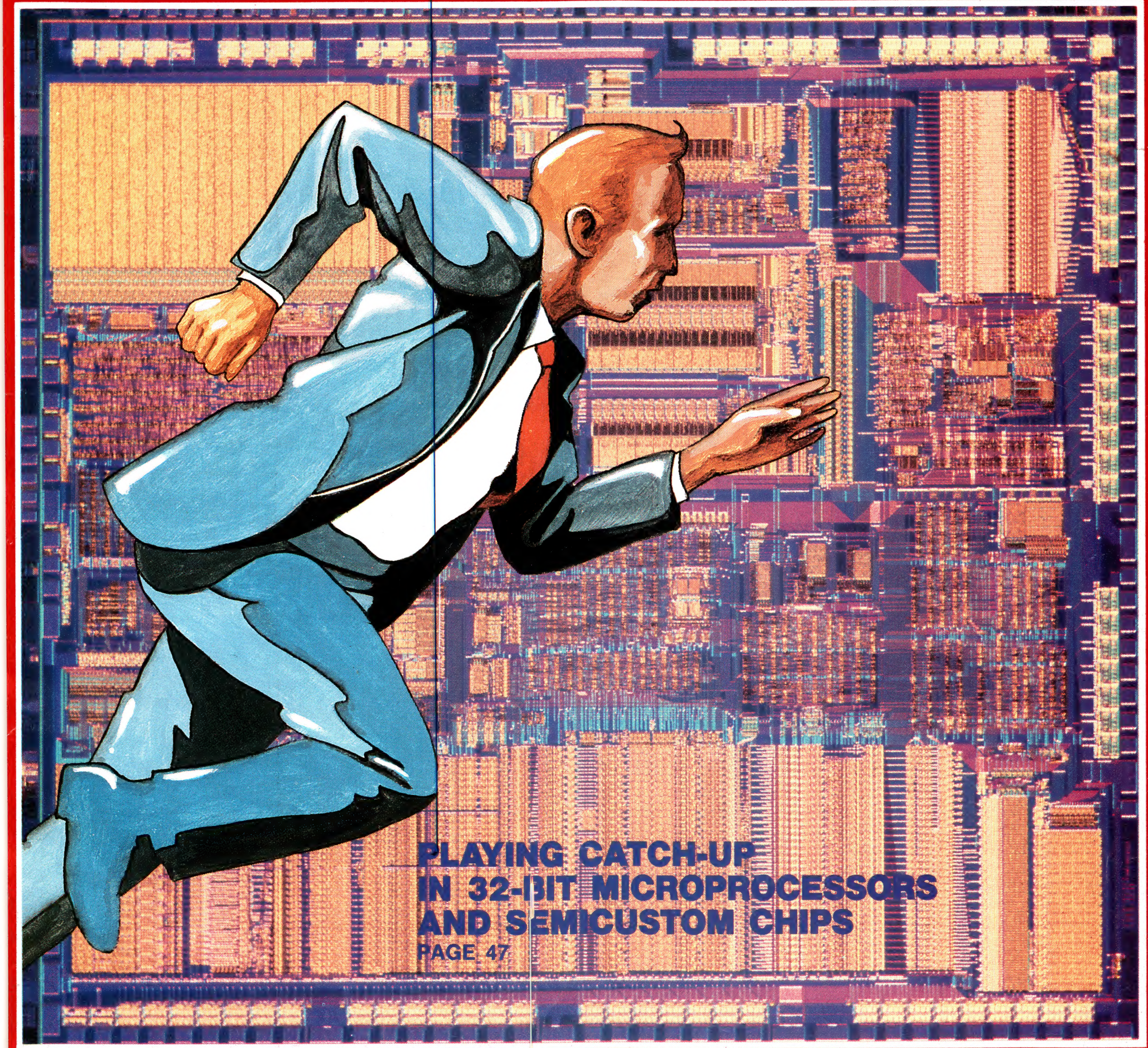

PLAYING CATCH-UP IN 32-BIT MICROPROCESSORS AND SEMICUSTOM CHIPS

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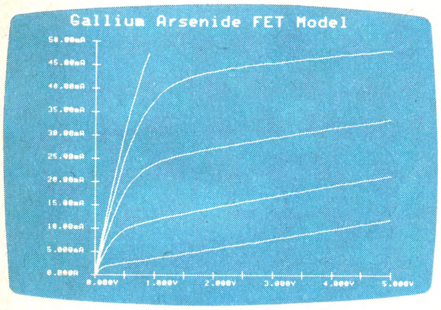
TECHNOLOGY UPDATE 3: TELECOM GIRDS FOR ISDN/64

CAE Software

Electronic Circuit Design & Analysis



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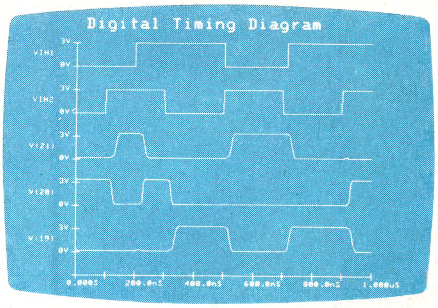

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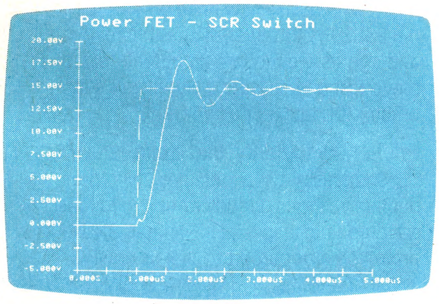

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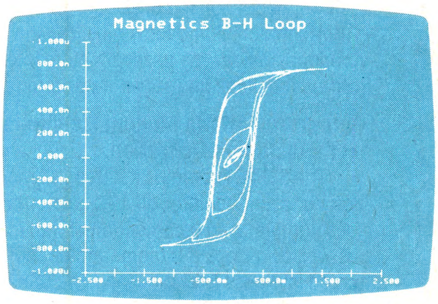

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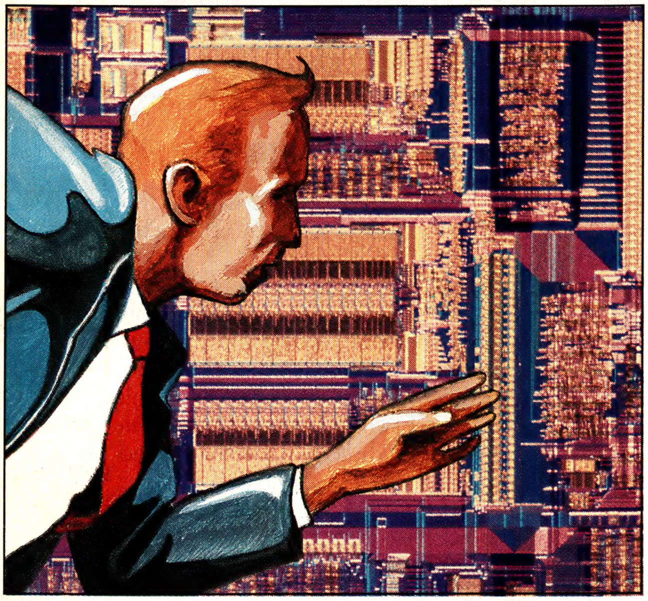
OCTOBER 21, 1985 VOLUME 58, NO. 42

Electronics

PROBING THE NEWS



COVER: How Intel aims to regain momentum, 47
To survive the semiconductor slump, the company that invented the microprocessor is making major decisions about products, marketing, and manufacturing. It has finally introduced a 32-bit processor, plans to get into the market for application-specific ICs, and has dropped DRAMs
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Work-station makers brace for IBM and DEC, 34
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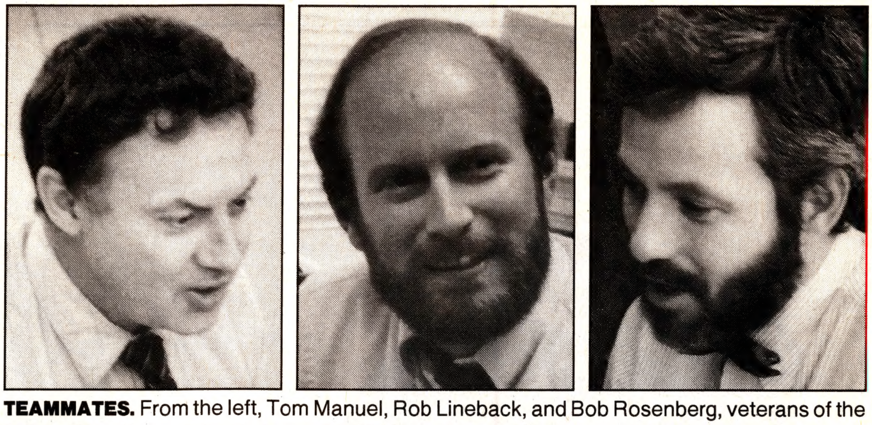

TEAMMATES. From the left, Tom Manuel, Rob Lineback, and Bob Rosenberg, veterans of the Token-Ring Network beat along with Cliff Barney, have been unearthing the net's details.

"The Token-Ring Network is such a big deal because it's IBM's," says assistant managing editor Tom Manuel, who directs our coverage of computers and peripherals. He was talking about our comprehensive coverage of the long-awaited announcement by IBM of its local network.

For readers of *Electronics*, the LAN's technical details are no mystery: we have been providing them right along. But lately, aware that the great revelation was imminent, we have intensified our reporting. In last week's issue, on p. 18, communications editor Bob Rosenberg did the curtain raiser—a discussion of how the Token Ring fits into the Systems Network Architecture, IBM's master networking plan. "We were prepared for all this," says Bob. "We knew the story would break in October, so we talked to the experts in advance."

And there's more. Coverage in this issue includes our lead news story, on p. 16, by Rosenberg with contributions from Manuel, plus a sidebar by Palo Alto bureau manager Cliff Barney on the crowd of LAN companies scrambling aboard the bandwagon. Then there is the Technology to Watch on p. 56 about Texas Instruments Inc.'s five-chip set that can provide full compatibility with the Token-Ring Network. It was written by Dallas bureau manager Rob Lineback. Also, for an update on how IBM's new product will fit into the rest of the communications world, you can turn to p. 64 for the Technology Update also by Rosenberg.

Summing up after a week on the Token-Ring beat, Manuel says, "There will be three local networks: Token Ring because IBM will have it, MAP [Manufacturing Automation Protocol] because GM will have it, and Ethernet because everyone else has it."

Laurence Altman

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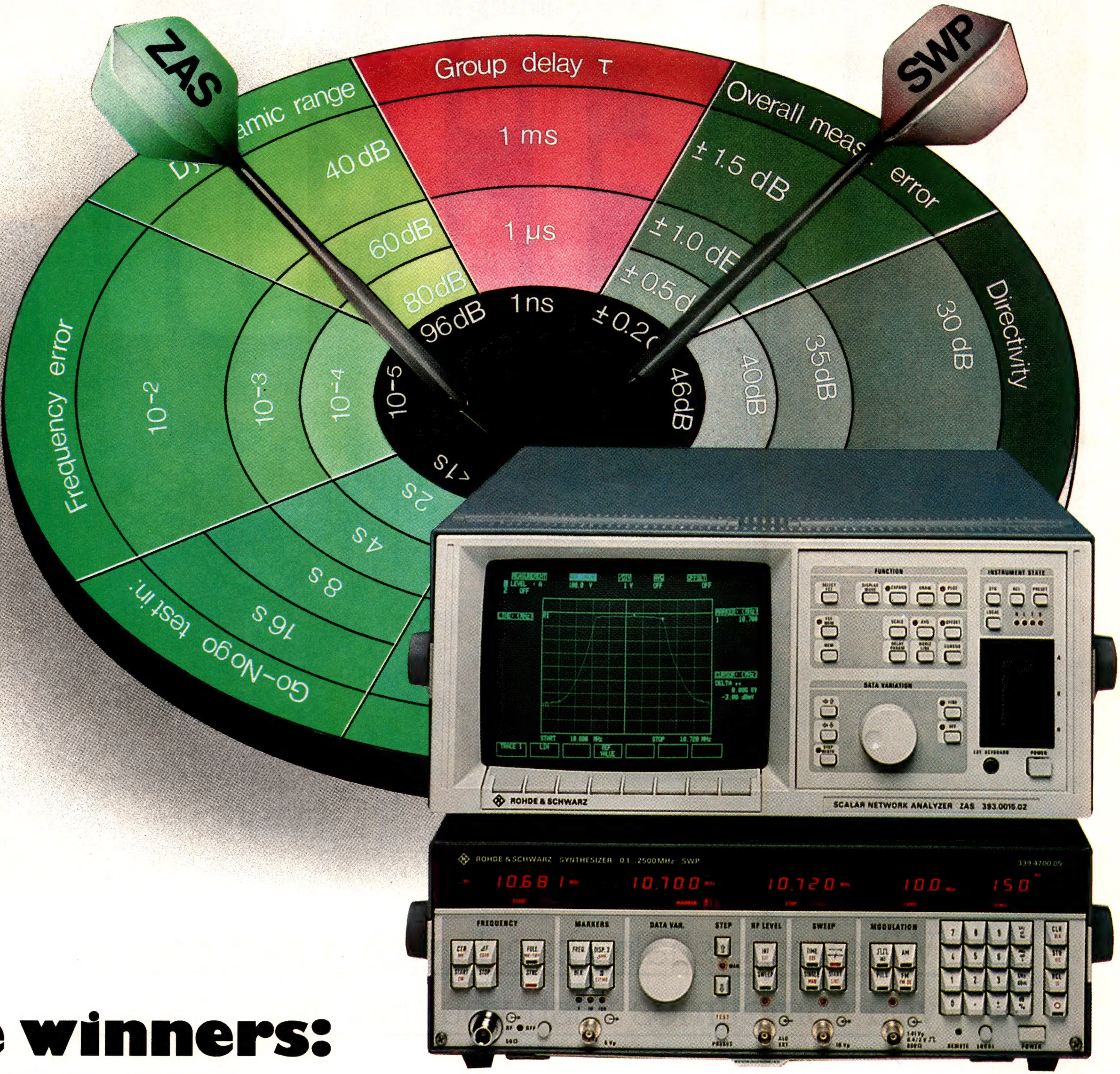

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ELECTRONICS NEWSLETTER

IBM UNDER-$10,000 WORK STATION EDGES TOWARD MARKET

IBM may have its long-awaited engineering work station on the market by next spring. Word came last week that a prototype of an under-$10,000 32-bit advanced work station has been installed in the computer science department of the University of California, Los Angeles, when UCLA professor Walter J. Karplus addressed the National Conference on Alternative Technologies for Class VI Computing at the Colorado School of Mines in Golden. Karplus showed a slide indicating that IBM's targets were a full 32-bit system, color graphics with 1,000-by-800-pixel resolution, 10 to 20 megabytes of disk storage, 512-K bytes to 1 megabyte of random-access memory, bus speeds from 2 megabytes/s to 40 megabytes/s, and a central processing unit running at 1 to 5 million instructions per second. IBM has promised an operating system based on AT&T Bell Laboratories' Unix; however, the exact implementation "is still up in the air," Karplus says. The prototype at UCLA is linked to the engineering school's work-station environment, which is hooked to three IBM 4300-series mainframes. Karplus says the plan is to add 60 more advanced IBM work-station systems when they become available next spring (see related story, p. 34). ☐

GENERAL ELECTRIC DEVELOPS CAT SCANNER FOR INDUSTRY

A new breed of CAT scanners should make for easier and more precise inspection of critical parts deep inside turbines and similar equipment. Previously used only in medical applications, General Electric Corp.'s computerized-axial-tomography machines are now looking at jet-engine turbine blades in GE's Madisonville, Ky., plant. Both X-ray power and imaging resolution (420 kV with 0.12-mm beam spacing) are substantially greater than in medical CAT scanners—enabling the unit to detect flaws as small as 1/100 in. An operator, viewing an enhanced cathode-ray-tube image processed by a Digital Equipment Corp. VAX 11/780, inspects each blade in the engine. An automated inspection module, now nearing completion, will be equipped with pattern-recognition capabilities to take over that task. ☐

TOSHIBA COMES UP WITH BRIGHTEST LARGE LCD SO FAR

Broad use in computer displays and wall TVs could be in the future for what Toshiba Corp. claims is the world's brightest large liquid-crystal display developed so far. The Kawasaki, Japan, company's LCD measures 10 in. diagonally (192 by 144 mm) and has a brightness of more than 300 candelas/m^2 in white, which nearly matches the brightness of a standard home color TV set. Toshiba's LCD, unlike conventional versions, is an active-matrix type, with an amorphous-silicon thin-film transistor that acts as a switch at each pixel to enhance picture quality. The new panel has a resolution of 640 by 480 pixels, with fluorescent backlighting, and can display eight colors. A competitor, Suwa Seiko Corp., announced a larger but less bright 13-in. color LCD display last week. ☐

MATRA-HARRIS SIGNS ACCORD WITH CYPRESS FOR CMOS, RAM TECHNOLOGY

Look for the Matra-Harris Semiconducteurs plant in Nantes, France, to start producing ultrafast static memories developed by Cypress Semiconductor Corp., San Jose, Calif., by the end of this year. The two companies recently signed a deal in which Cypress will transfer its 1.2-μm CMOS technology, along with masks for its 25-ns 4-K and 16-K static random-access memories, to Matra. In return, it will get 2% of the French company's common stock and an undisclosed amount of cash. The two companies also agreed to forge a similar deal for Cypress's 0.8-μm technology and 64-K SRAMs. ☐

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HC-5508	SLIC	Reconfigured and enhanced version of HC-5504
HC-5510/11	PCM CODECs	μlaw/A-law coding with signaling capabilities
HC-5512/12A	PCM Filters	Exceed all D3/D4 CCITT specifications
HC-5512D	PCM Filter	MIL spec
HC-5554/57	CODEC/Filters	μlaw/A-law COMBOs
HC-5541A	Dialer	Pulse-tone dialer
HC-55536/64	CVSD	Real-time speech processors
HF-10	UAF	Univ. Act. Filter, MIL Temp.

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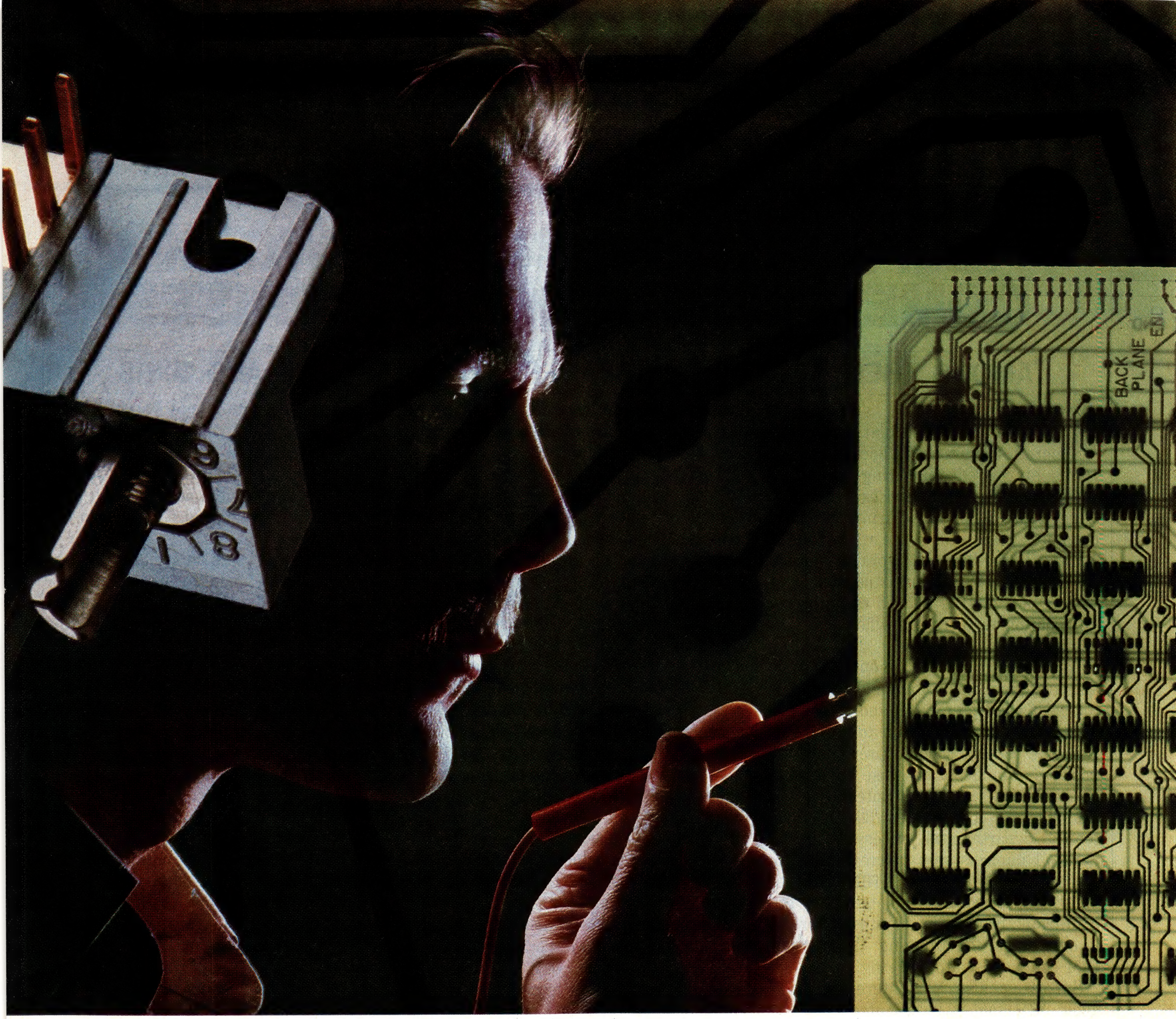

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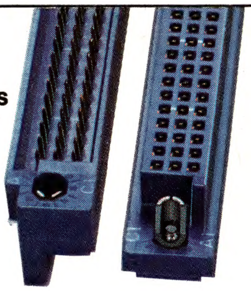

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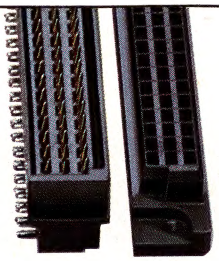

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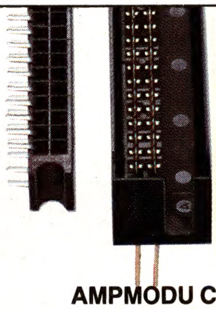

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Circle 15 on reader service card

other products currently without adapters to the ring. Netbios was initially offered as part of the PC Network, and IBM is readying a version to connect the token-ring with a PC Network—though a PC must be dedicated to running the interconnection program to form the bridge between networks.

Any PC on the network can act as a gateway to the System/36, System/38, Series/1, and members of the System/370 family to provide communication between applications. It does so by implementing the Systems Network Architecture Logical Unit 6.2 and Physical Unit 2.1 protocols, which support peer-to-peer communications. An asynchronous communications server program (also running on a dedicated PC on the ring) permits ASCII-to-EBCDIC communications over a circuit-switched network by means of a private-branch-exchange passthrough facility.

Along with the Token-Ring Network, IBM rolled out several intriguing pieces of voice-synthesis and -recognition hardware and software. Although these products are not part of the network per se, they underscore what may become an important capability of the network—the integration of voice and data communications. *–Robert Rosenberg*

TOKEN-RING BANDWAGON IS ALREADY CROWDED

IBM had delayed for so long the formal announcement of its Token-Ring Network that by the time the bandwagon was ready to roll last week, a lot of passengers were either already on board or at least ready with a ticket to ride. By the second quarter of 1986, more than 25 companies will have announced some 100 products for IBM's IEEE-802.5 local network based on Texas Instruments Inc.'s chip set, TI says.

At least half a dozen firms made their announcements at the same time as IBM. Three of these are Silicon Valley networking companies—Ungermann-Bass Inc. of Santa Clara, and 3Com Corp. and Bridge Communications Inc. of Mountain View. All three have built their current product lines around Ethernet, the rival local-network protocol formalized in IEEE specification 802.3.

Bridge Communications and 3Com will use the TI chip set in developing a variety of servers and gateways that will support token-ring networks and tie them to existing 802.3 networks. Ungermann-Bass, which has developed its own token-ring controller chip [*Electronics,* July 15, 1985, p. 17], extended its complete product line to allow users to build multiple-ring systems and link them with 802.3 networks.

In addition, Proteon Inc., a Natick, Mass., company that has proprietary 80- and 10-Mb/s token-ring networks, announced that it too would use the TI chip set to develop a 4-Mb/s version compatible with the IEEE-802.5 token-ring specification supported by IBM. Nestar Inc., of Palo Alto, will make the IBM protocol a standard feature of its token-bus local-area network, which is based on Datapoint's Arcnet.

SOFTWARE BRIDGES. Sytek Inc., another Mountain View company, will provide a gateway between the token ring and the PC Network IBM announced last year; the PC Network uses Sytek's broadband carrier-sense/multiple-access with collision detection (CSMA/CD) protocols. And Novell Inc., of Orem, Utah, whose networking software runs on the PC Network, will provide a software bridge to the new token ring that will link it with a variety of proprietary local networks.

The flood of new announcements far outstripped the modest offering of IBM itself, which announced support for its Personal Computers only. The tacit acceptance of the new network as an industry standard, however embryonic, was made explicit by Ungermann-Bass, which stated flatly that it expects token-ring technology to provide a "major portion" of its sales revenues by 1987.

Ungermann-Bass's product offering includes a ring-to-ring bridge. For customers using the ring's less expensive Type 3 cabling (unshielded twisted pairs), the company pointed out, such a bridge is necessary to overcome the network's 72-station limit. A bridge can also be used to go beyond the 260 devices IBM says can be connected to one ring if the more costly Type 1 and Type 2 cabling is used. Like 3Com, Bridge, and Proteon, Ungermann-Bass will later offer gateways to Ethernet, as well as to IEEE-802.4 (the Manufacturing Automation Protocol that General Motors Corp. is promoting) token-bus networks.

TRANSPARENT LINKS. 3Com's token-ring product is an option to its network server, which will also have an Ethernet connection and gateway software. Such networks will have transparent links for users, who will be able to access programs and data on connected nets, according to 3Com vice president Howard S. Charney.

Bridge took a similar approach by offering an extension to its Multibus-based line of gateways and servers. Bridge said its products will complement 3Com's, and the company will continue to support and enhance its Ethernet products.

Even Sytek, which does not make an 802.3 product, expects the 10-Mb/s Ethernet to continue to play a role in the market. "Ethernet will compete where users need high performance, such as in computer-assisted-engineering applications," said Sytek president Michael S. Pliner. Sytek expects its PC Net, which can accommodate 1,000 nodes over a 5-km stretch, to be used in wide-area networks, while the token ring finds applications in departmental nets.

3Com, however, has a different view. "The token ring is a fine method for interconnection of corporate LANs," Charney maintains. "But Ethernet is still the best choice for an individual work group."

William N. Carrico, president of Bridge Communications, argues that Ethernet will survive because it has a three-year jump on the token ring and is inherently cheaper, requiring only two chips to TI's five. However, Carrico admits, the Token-Ring Network will inevitably take its place as a standard, if only because it is endorsed both by IBM and an industry committee, 802.5. "That," said Carrico, "may well be an industry first." **–Clifford Barney**

BUSINESS ABROAD

CAN U.S. FIRMS STAY IN S. AFRICA?

SCHAUMBURG, ILL.

When Motorola Inc. announced earlier this month that it had sold the last of its factory operations in the strife-torn Republic of South Africa, the move drew attention to what is becoming a worrisome problem for U. S. companies doing business in South Africa.

The subsidiary Motorola sold makes mobile and portable radios in a 44,000-ft^2 Johannesburg factory that employs 225 people [*Electronics,* Oct. 14, 1985, p. 31]. The buyer—a leading South African electronics company known as Allied Technologies Ltd.—has agreed to continue Motorola's policy of not selling equipment made at the factory to the South African police or military, a Motorola spokesman says. "If the terms of that agreement are violated, we can terminate the license." But antiapartheid groups strongly question whether Motorola has kept or Allied can keep the radios out of the hands of South African police and military personnel.

U. S. companies are under pressure at home to pull out, based on moral objections to the racist South African apartheid system. U. S. antiapartheid groups have singled out computer and electron-board-testing systems and will eventually go on to digital test systems. Another board-test company, Megatest Inc., San Jose, Calif., is gearing up a testing and design facility. Wiltron Co., Mountain View, Calif., has opened its own office to market its test systems for telecommunications and microwave equipment. In addition, board-tester maker LTX Corp., Westwood, Mass., has set up a testing and assembly office in Tokyo, and in a joint venture, GenRad Inc., Bolton, Mass., and Tokyo Electron Ltd. are producing board testers.

Local production could help boost market share

Five years ago, such Japanese companies as Takeda Riken (now called Advantest), Ando Electric, and Anritsu Electric captured their home market by producing systems designed to match the needs of Japanese manufacturers.

Teradyne began assembly of logic testers in Japan late last year and will produce them at a temporary new facility in Tokyo before investing some $750,000 to purchase a larger plant site just outside the Japanese capital. The company plans to increase its engineering staff from the present 15 to perhaps 80 within the next two years and to double its overall staff of 150.

"There's a whole new generation of testers now being developed for megabit memory," says Richard Dyck, a director of Teradyne Ltd. (Tokyo). "And they have very different specifications from previous systems. The only way we're going to keep penetrating this market is to manufacture and engineer here."

RETHINKING STRATEGY. Apart from design changes, other fundamental factors demand a strong presence in Japan, according to Dyck. Until now, production-oriented Japanese customers wanted the lowest-priced test system possible, even if it meant a sacrifice of flexibility in programming. But faced with the most costly commodity-product market slump they have ever experienced, Japanese executives are rethinking their basic product strategies, Dyck goes on.

These companies may want to produce more complex, value-added products, he says. "And if we're going to have the right [test] products for this changing market, we've got to be on the scene, working as closely as we can with our customers."

A competitor views the Teradyne strategy with irony. "Five years ago, Teradyne lost a lot of credibility in the Japanese dynamic memory market because they failed to respond to customer needs," says one executive.

However, Teradyne has a "better than 40% share of the noncaptive Japanese market for analog testers, especially consumer linear devices," claims Dyck. It hopes to boost its share now that it is making the testers in Japan. But Japanese-based production of more advanced-memory test systems is about two to three years away, says Dyck.

Megatest's Japanese subsidiary, Nippon Megatest Ltd. of Tokyo, is taking a different tack by redesigning its test stations for erasable programmable and conventional read-only memories. "The nonvolatile memory market is going to start to take off next year," predicts company president Minoru Takagi.

Takagi figures that the Japanese EPROM and EEPROM markets will be worth close to $24 million in 1986, and the overall digital test market in Japan will be worth about $174 million, he says. Although Takagi wouldn't reveal Japan sales figures for his company, he does say that sales doubled in the fiscal year ending in August and will triple in fiscal 1986.

Wiltron, with sales in Japan last year of $530,000, is trying to boost growth in its largest overseas market. Sales for 1985 probably won't match last year's figures, says managing director Katsumi Masaki of Wiltron's recently opened office in Tokyo. But as the deregulated telecommunications market begins to take off next year, he predicts that test-equipment sales will recover strongly.

"Some American firms finally have awakened to two basic facts," sums up Karen Mavec of Tokyo's Jardine, Fleming (Securities) Ltd. "The Japanese market is second in size only to the U. S., and it is a window to all of Asia. A manufacturing presence here could be a matter of survival." *–Michael Berger*

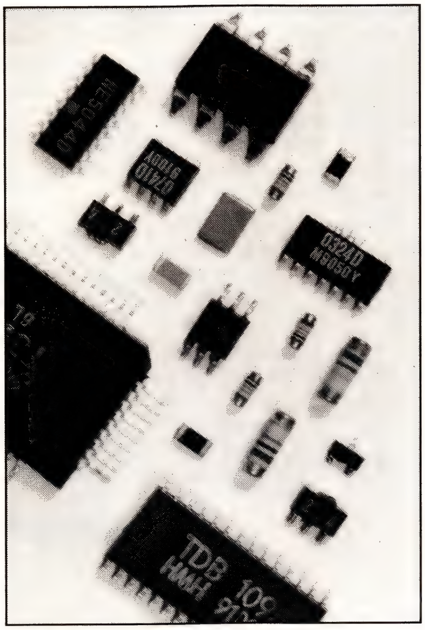
PACKAGING

INDUSTRY WARMS TO HP'S IDEAS ON SMD SIZES

SANTA ROSA, CALIF.

Hewlett-Packard Co., like many manufacturers in the industry, feels constrained by the stalled efforts to standardize the body characteristics of surface-mounted devices. Unlike the other major users of surface-mounting technology, however, HP is proposing its own set of specifications.

The Palo Alto company is making its proposals in hopes of "heading off the proliferation of competing package styles," says Steve Hinch, SMT program manager for HP. Not surprisingly, however, there are a number of details in the proposals that look to become bones of contention. But despite this, and the fact that there are on-going committees within a number of industry associations dealing with the problem, the HP proposal has elicited considerable support—in principle—from other participants in the industry.



TOO MANY TYPES. Hewlett-Packard wants tighter standards for surface-mount packages, especially for discrete components.

HP, which has been using surface-mounted devices in volume production since 1981, introduced its proposals at Expo SMT, held earlier this month in Las Vegas by the Surface Mount Technology Association of Los Gatos, Calif. The recommendations address physical characteristics and do not attempt to define new electrical parameters for surface-mounted devices, Hinch says.

The recommendations apply to commercial resistors, ceramic and tantalum capacitors, wirewound inductors, discrete semiconductors, and linear and logic integrated circuits. Memory devices are not addressed.

Though many are welcoming HP's lead, Hinch expects a few hitches as the proposals are discussed. He is not surprised to find that there are several controversies about HP's recommendations, but the arguments are "much more detail-oriented than I expected." He thinks manufacturers will take issue with HP's definitions for mechanical standards on tantalum capacitors, wirewound inductors (for which there are currently no international stanjoy-stick controls, the operator can adjust the color balance before storing the image on disk. Kodak will also make available models that will capture images on slides and print film in such formats as 110 and disk.

The home player/recorder can be used to play back disks recorded from film and transferred at a processing station, or to record and view images taken from a videotape, videodisk, computer, or television receiver. Only one of the two interlaced video fields in a standard TV frame is stored, in order to provide the maximum amount of storage space on the disk, Paxton says. On playback, every other line is generated through interpolation, he says.

Bernoulli effect is key to tracking system

With 50 concentric tracks on a disk, each track holds a single video field, or about 240 lines of NTSC video. Recorded with an analog frequency-modulation technique, the disks are played back using an amorphous-metal playback head just 50 μm wide. The tracks are on a 100-μm pitch and are 60 μm wide. Kodak is working on a higher-resolution unit that will have two heads and electronics to toggle back and forth between two field signals on two tracks.

Paxton estimates disk life to be about 24 hours per track, and says that period is lengthened by Kodak's unique tracking technique. Rather than press the disk between tension pads and the playback head, as in a cassette recorder, the Kodak drive takes advantage of the Bernoulli effect caused by the high-speed rotation of the disk. The disk is turned at 3,600 rpm by a dc brushless motor, and the rotation creates a vacuum between the head and the disk strong enough to pull this disk within reading distance of the head but light enough to avoid damage to the disk's surface. "Tracking has to be excellent," Paxton says.

The small disk, intended for use in cameras, presented Kodak with some major technical challenges. To get an acceptable signal-to-noise ratio, the company called upon a technique called nonlinear pre-emphasis, which was developed for use in Kodak's 8-mm videotape players.

During recording, higher-frequency signals and signals with relatively low amplitude must be boosted to avoid distortion. On playback, the signals must be de-emphasized and returned to their original state. *–Tobias Naegele*

SPINNING LENS PROJECTS UPDATABLE 3-D IMAGE

TOTOWA, N. J.

In a back room at Ampower Technologies Inc.'s headquarters, a pair of luminescent green cubes float in a black void. One cube begins to rotate, shrinks to a smaller scale, then reverts to its original size and orientation. Later, the cubes are replaced by a glowing conical cylinder that, flickering softly, could be pointing the way to the future of three-dimensional imaging.

Though all this may sound magical, Bernard Ciangoli, Ampower's founder, president, and chairman, insists it isn't done with mirrors. Instead, a large, spinning lens figures prominently in the first-generation prototype of a machine that can project an updatable, full-motion 3-d image into free space.

One foot in diameter and more than 3½ in. thick at its core, that lens also figures prominently in the future success or failure of Triology Systems Inc., a wholly owned Ampower subsidiary. Triology is now looking for $2.5 million from investors—an amount the company's president thinks is needed both to develop a second-generation model and to plant the seeds for production and marketing efforts.

The machine represents an advance over the apparent 3-d seen on some graphics terminals used for analysis and modeling. It has an advantage over holographic projection because the holographic image is based on a film image and therefore cannot be changed as data changes. So the system combines the appearance of holography with the updatability of a data terminal.

In the first-generation model of Triology's XYZ scope, the lens is set up 18 in. from a Hewlett-Packard Co. 1311B XY-scope cathode-ray tube, which is fed analog 3-d data from a computer by way of two digital-to-analog converters. The 3-d data is then displayed on the two-dimensional CRT screen, passed through the rotating lens, and projected 18 in. forward.

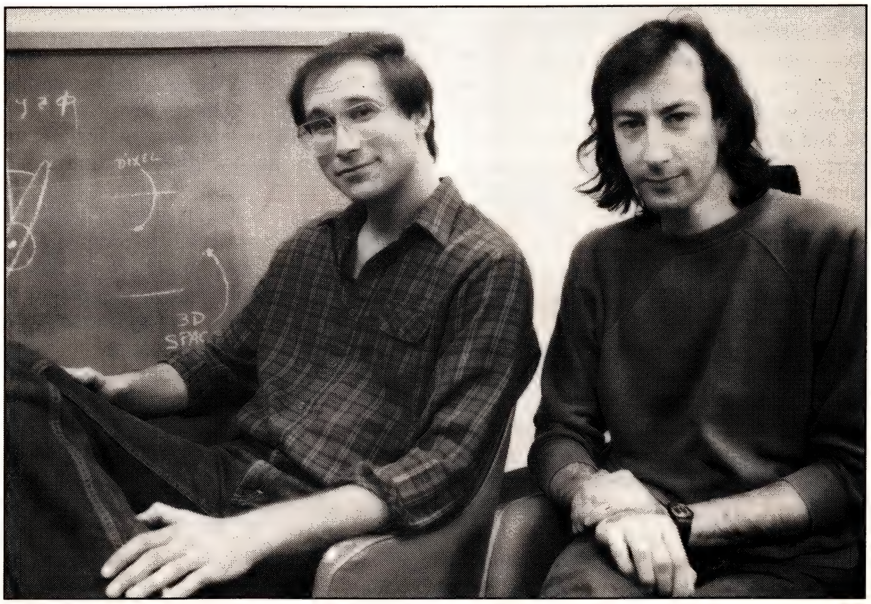
There it appears as a complete 3-d form, viewable from head-on, right, left, top, and bottom positions. A rotation rate of 480 rpm along the lens' east-west axis throws the image forward.

EARLY PROBLEMS. Problems to be worked out in the prototype include flicker that mars the clarity of the image, image distortion due to the curvature of the lens, and poor resolution (64 pixels). Nevertheless, the model proved the plan feasible. Richard Gorde, a software engineer with Triology and Ampower, says its problems will be relatively easy to overcome.

Flicker will be the easiest problem to lick, Gorde says. Resulting from the relatively slow rotation speed of the lens, flicker can be eliminated by boosting the rotation speed to something close to 3,600 rpm.

The spherical aberration, or distortion, can be solved in software, according to software engineer Bruce Brody, by predistorting the image. Given the degree of distortion, coordinates can be plotted to compensate for that distortion.

A far greater problem, however, is posed by the 2-d display used to project an image through the moving lens. The



NO PROBLEM. Richard Gorde and Bruce Brody, software engineers for Triology Systems, think most problems with the 3-d projection prototype can be easily worked out.

into main memory. That process is what slows the execution of PISA software on conventional hardware.

Associative-search hardware, with which the PISA consortium aims to overcome this speed shortfall, takes the form of a nonvolatile associative cache system in the Poppy subsystem. Poppy's cache, which consists of conventional random-access memory backed by lithium batteries, works with a National Semiconductor Corp. 32032 microprocessor operated in its indirect-addressing mode to translate object names into disk addresses. A compiler has been written for Poppy, whose 32-bit address range will be extended to 64 bits in a full-scale system. *–Kevin Smith*

MILITARY

ARE HARD TIMES AHEAD FOR DEFENSE INDUSTRY?

SAN DIEGO

Defense spending statistics would, at first glance, seem to indicate a robust future for U. S. military electronics suppliers. With Congress embarrassed by the need to hack down the federal budget deficit each year, however, politics could overtake statistics.

The figures have been bright so far this decade. Gear with ever-greater technology content has steadily nabbed a bigger part of total defense spending, which grew from $176 billion in fiscal 1981 to nearly $285 billion in fiscal 1985—which amounts to 40% of the appropriated funds for hardware and research. And in its annual 10-year projection of military spending the Electronic Industries Association predicts the electronics portion will climb another 3.2% while overall defense appropriations drop slightly [*Electronics*, Oct. 14, p. 13].

Tough steps to limit spending are certain

Yet two industry officials who worked on the report see a new era of austerity coming. Laurence B. White, session chairman for the committee that did the forecast, says, "It's a time of belt-tightening, trying to live in a new environment." William A. Heuslein, forecast chairman, adds, "We expect no true growth, and new initiatives will be extremely limited."

Because it is prepared by knowledgeable insiders from the contracting community who consult with key sources in the Defense Department, other parts of the Administration, and Congress, the EIA projection has gained wide credibility. So military-electronics executives value it highly as a tool for seeking new business.

Congressional wrangles so far have delayed any definitive cuts in defense appropriations. But EIA forecasters warn that tough steps to limit defense spending are a certainty.

The hardest hit could be President Reagan's Space Defense Initiative, the source of much of the military-electronics spending projected for the next 10 years. According to current plans, research and development will dominate in SDI's early phase, then decline slightly as procurement gets underway (see table below). Yet SDI is jeopardized by skepticism about both its feasibility and its cost (see p. 45).

"The [budget] deficit is the No. 1 problem," emphasizes Heuslein, who is assistant to the president of Grumman Aerospace Corp. Adds White, who manages requirement analysis and market research for Rockwell International Corp.'s Defense Electronics Operations: "What it all boils down to [is that] funding constraints will not finance needed modernization."

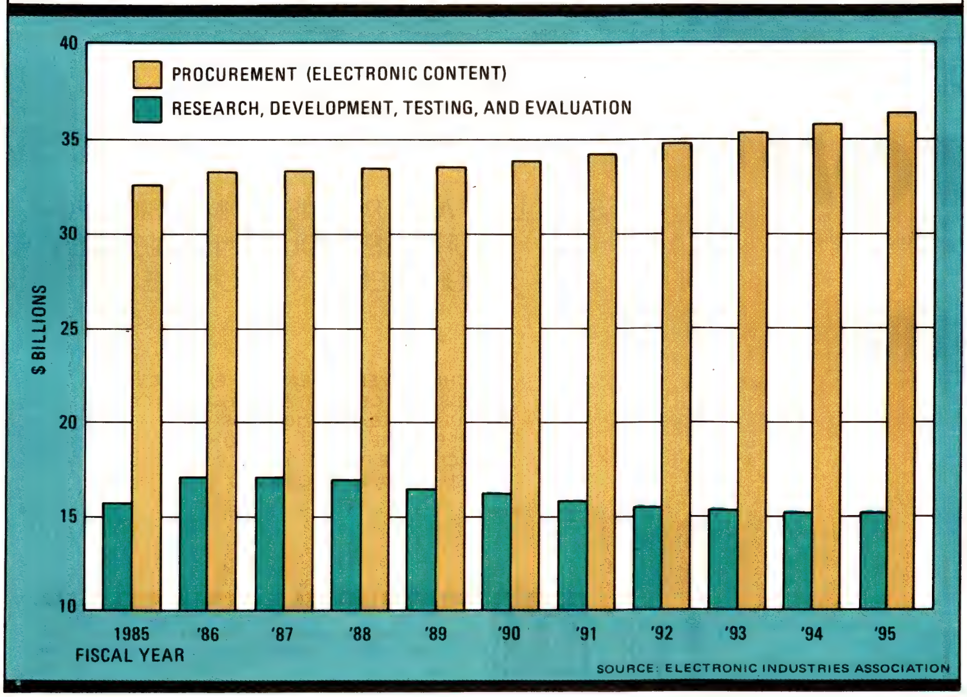
SWEEPING MOVES. Contractors accustomed to being the sole source for equipment after winning a contract will be perplexed by a sweeping move service procurement officials are making toward both dual and second sourcing. Warns Heuslein, "Competition, second sourcing, teaming . . . will become a way of life, and you better get used to it."

The U. S. Navy has been a trendsetter in saving money by forcing vendors to compete. About 45% of its 1985 purchases were subject to competition, compared with 30% in 1983. Other services are following; the Air Force, for example, put 33% of its purchases up for competition in the last fiscal year. Furthermore, Congress is requiring competition more often on some contracts. A leaner period ahead would come as a radical change from the free-spending first half of the 1980's, when business opportunities in military electronics abounded as never before.

The best prospects for new technology business in the new climate may be in the computer sciences, which the EIA says have top priority in defense plans. The computer sciences have wide application: in device research (very high-speed integrated-circuit, gallium-arsenide, and very large-scale-integration architectures), in parallel and symbolic computer architectures, and in software that includes DOD's Ada language and other artificial-intelligence programs.

So-called "smart munitions" might also get a big push—if the funds are there. "We'll have a better view in January when the 1987 budget goes to Congress," says EIA committee member White. *–Larry Waller*

DEFENSE ELECTRONICS R&D WILL FALL WHILE PROCUREMENT RISES



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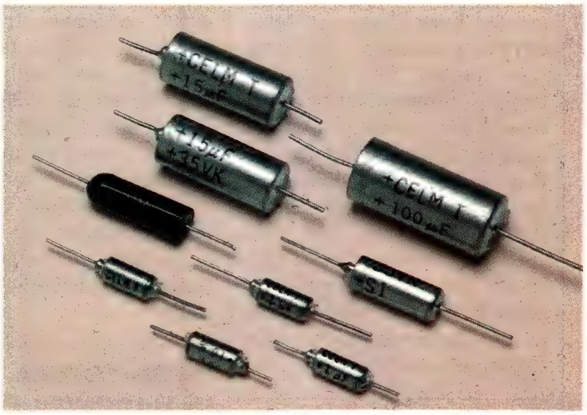

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ness for the two to be competing," Richardson explains. "Our overall plan was to buy them both, put them together, and eliminate the competition."

The plan worked. In two years, Richardson was able to raise gross margins from about 35% to more than 50% at the two operations. The company now has similar efforts under way at Calvert and CECO, with a goal of matching the 40% gross margins it achieved on a company-wide basis last year. "Our challenge is to increase prices, reduce costs, and not lose customers," says the chairman. Prices must be raised slowly, though, to avoid scaring customers away, he says.

ACCENT ON SERVICE. An ingredient even more important in the Richardson formula than price may be service, says Robert A. Sullivan, a vice president at Paine Webber Inc., New York. Richardson makes about 85% of its sales to the replacement market, which in most cases means the client wants the part in a hurry. A customer who faces downtime costs of as much as $40,000 per hour if an auto welding line goes down for lack of a $250 ignitron tube, for example, is not likely to quibble over price.

To meet the service challenge, Richardson maintains an inventory of 14,000 products, claimed to be the most extensive in the industry. The Richardson line includes power tubes, thyratrons, tube rectifiers, traveling-wave tubes, klystrons, ignitrons, magnetrons, phototubes, CRTs, power semiconductors, and spark-gap tubes. The broad inventory, coupled with a computer network that ties in Richardson's seven domestic sales offices and three international offices to its multiple manufacturing and distribution locations, allows the company to make same-day shipments on 98% of all parts ordered, it claims.

"We want to be at a $200 million to $300 million annual run rate within five years," Richardson declares. From last year's $55.5 million mark, that means growth of 29% to 40% annually between now and 1990. Richardson figures to generate 20% of that by boosting sales internally. The rest, he says, will come through continued acquisitions. "We see more opportunities for acquisitions out there than we have time to digest."

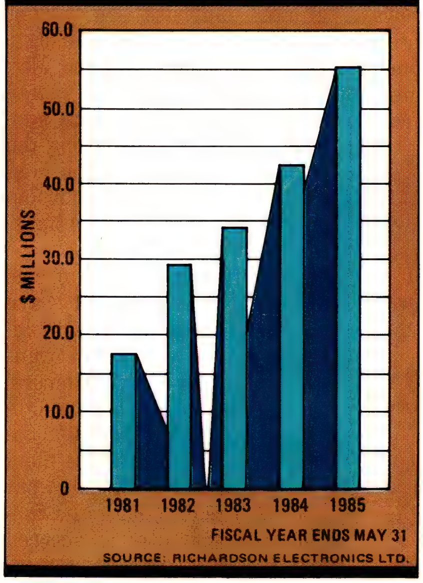
Industry watchers believe Richardson can achieve its goals. Paine Webber's Sullivan believes 20% growth is possible "and I wouldn't be surprised to see them grow somewhat faster—maybe 30% with acquisitions."

Others aren't so sure. "There are no longer any major [specialty tube] distribution organizations for Richardson to buy," notes Ronald D. Ordway, chief executive officer at Video Displays Corp., a Stone Mountain, Ga., company that makes and distributes CRTs. "He's bought them all, so he can't keep growing that way."

GROWTH IN CRTs. But Richardson plans a bigger push into the CRT-replacement business. The company expects to double its CRT sales this year to about $1 million, he says. And although Richardson expects only gradual penetration by newer technologies into the replacement-tube market, the company is hedging its bets by also pursuing the power-semiconductor business, which accounted for 13.5% of its sales in fiscal 1985.

Despite thrusts into other markets, there is still plenty of room for growth in the domestic tube business, the chairman believes. International sales may represent an even greater opportunity, he says. "We're prejudiced, but we really think we've carved out a nice little niche on the trailing edge of the business that's going to be a lot of fun for a long time to come." *–Wesley R. Iversen*

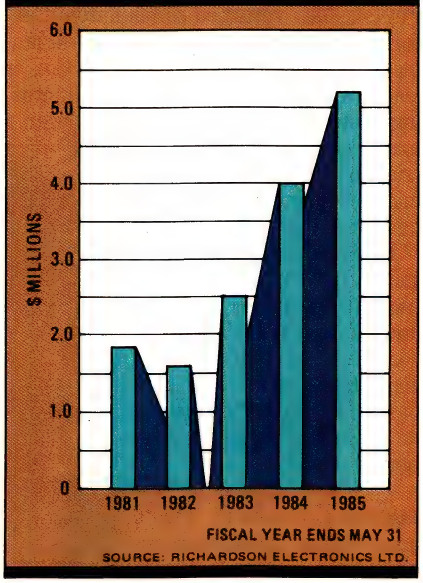
RICHARDSON'S SALES ARE GROWING . . .



FISCAL YEAR ENDS MAY 31

SOURCE: RICHARDSON ELECTRONICS LTD.

. . . AS ARE ITS EARNINGS



FISCAL YEAR ENDS MAY 31

SOURCE: RICHARDSON ELECTRONICS LTD.

BOTTOM LINES

GENERAL SIGNAL BUYS TEST-EQUIPMENT LINE

General Signal Corp. has acquired the Northeast Electronics line of telecommunications test instruments from Northern Telecom Inc., Nashville, Tenn. Terms of the deal were not disclosed. The product line includes test, diagnostic, and maintenance instruments for transmission, signaling, service analysis, and switching, and for carrier and trunk surveillance, according to the Stamford, Conn., company. With its new products, General Signal will be able to serve a wide range of the analog test and measurement needs of most domestic and foreign telephone companies, the company said.

GOULD SELLS OFF MEASUREMENT UNIT

Gould Inc., the diversified electronics company based in Rolling Meadows, Ill., has sold its Measurement Systems Division to Solartron Electronics Inc., a subsidiary of Schlumberger Ltd., New York. Terms were not disclosed. Based in Oxnard, Calif., the Measurement Systems Division makes differential pressure transducers and strain gauges for industry and government markets. Gould announced in December 1984 that it planned to sell assets not linked to its strategy in electronics.

SISCAN SYSTEMS GETS FIRST-ROUND FUNDING

SiScan Systems, a maker of integrated-circuit inspection tools, has ended its first round of venture funding. The Campbell, Calif., company said it has raised $4 million. With the funds, the company intends to build a manufacturing plant and introduce its SiScan-1 wafer inspection system. The $200,000 Siscan-1 is a manually loaded auto-sequenced inspection system for all levels of wafer processing. It uses a laser microscope that can display and record magnifications up to 16,000× compared with existing optical microscopes that can magnify 1,000×.

EMERSON BUYS MIDWEST COMPONENTS

Emerson Electric Co., St. Louis, has acquired Midwest Components Inc., Muskegon, Mich., for an undisclosed sum. Emerson said Midwest Components, a manufacturer of electronic temperature-sensing devices, will report to its Therm-O-Disc Division, which manufactures a broad line of temperature controls and thermal cutoffs.

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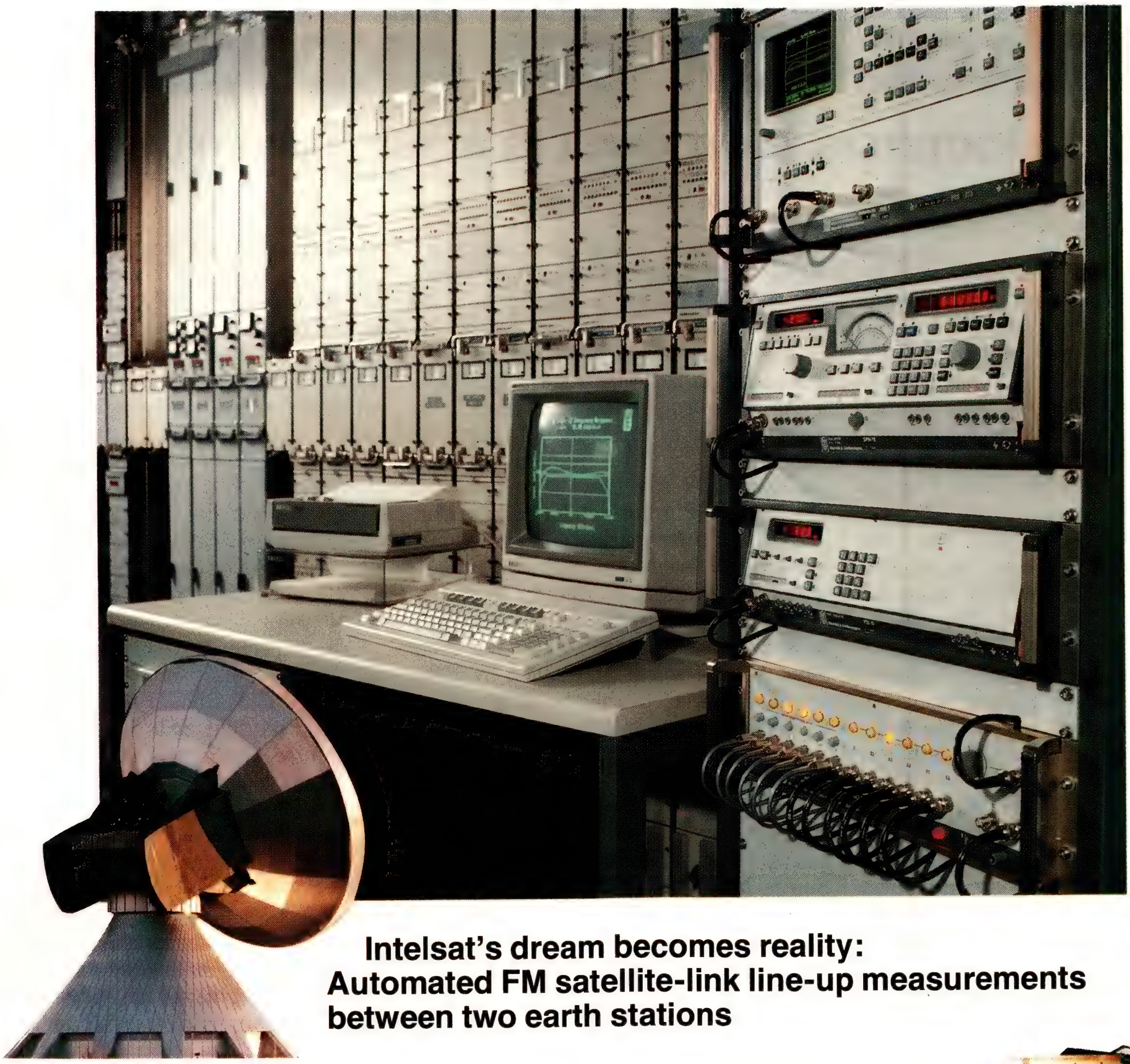

Intelsat's dream becomes reality: Automated FM satellite-link line-up measurements between two earth stations

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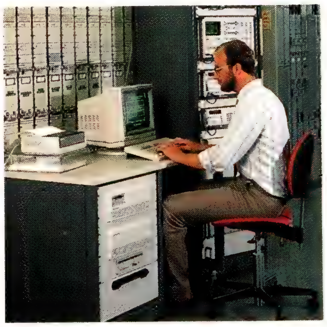

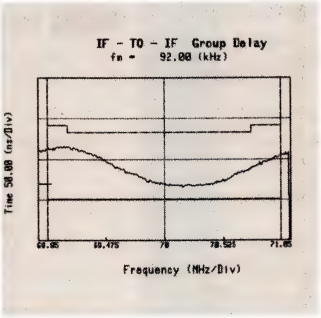

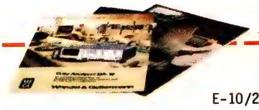

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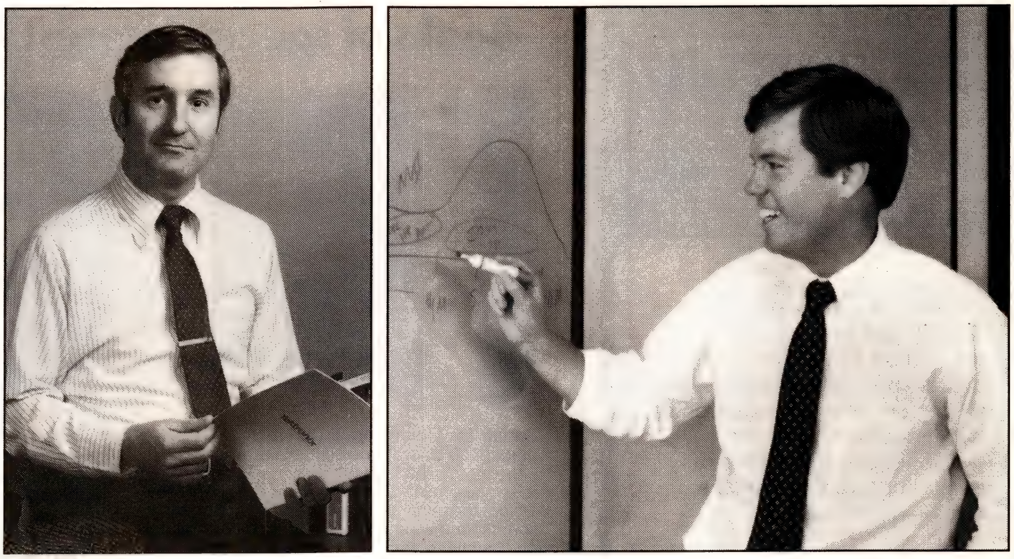
for its strong links to other systems.

Sun claims to be gaining market share on Apollo, which was far in the lead until early 1985. Apollo claimed to have sold 12,000 units by June 1985; Sun announced 11,500 at the end of September. McNealy hedges about Sun's position in 1990, but Michael Gallup, who is Apollo's director of marketing in Chelmsford, Mass., is willing to speculate on the future.

"I'm sure [IBM] will sell a ton of whatever it is," he says, noting, however, that IBM is confronting an unfamiliar customer with work stations—the discerning technical user. Also, DEC will make a strong showing with its MicroVax products. "They will do very well," he says. "I would expect DEC to get upward of 20% of the market." The question for Apollo is whether it will have "5% or 35% of the market in 1990. It's not going to be 65%," a share he claims the company now enjoys.



TWO VIEWS OF THE MOUNTAIN. George Rhine of Tektronix, left, believes taking on IBM and DEC is taking on trouble. But Sun president Scott McNealy, right, says his company's software strength makes a difference.

FAMILY OF ONE. Market share became the critical issue for Tektronix Inc. In late August, after having spent tens of millions of dollars developing a family of work stations based on National Semiconductor Corp.'s 32000 microprocessor, the Beaverton, Ore., company dropped all but one of the line because of IBM's Personal Computer AT and DEC's MicroVax II.

"When we started our work-station activity a couple of years ago, they weren't market forces," recalls George Rhine, operations manager of the Graphics Work Station Division for the Information Display Group. After purchasing a company that made CAE software, "we recognized that we wanted to have our software on industry-standard, not proprietary, platforms."

As a result, Tektronix will sell systems based on MicroVax IIs as part of its longstanding original-equipment-manufacturer agreement with DEC and markets only two work stations. One, the 6130, was developed in-house and uses the 32016 coprocessor to run Utek, Tektronix's version of Unix. The other is an IBM PC AT-based work station that runs Utek off a 32016. "Any company who tries to take on IBM and DEC in the work-station market is in a vulnerable position," Rhine says.

Daisy Systems Corp.'s recent move to sell MicroVax II-based products under a two-year, $50 million agreement with DEC echoes that sentiment. Though the Mountain View company successfully sold its own work stations and software into the CAE market, Burdick of Dataquest believes the announcement is significant because it "further clarifies the way the market is going: turnkey vendors [like Daisy] are unbundling their systems and becoming software vendors, and will have to run on all the commodity products out there."

Not surprisingly, DEC does not want to consider itself part of the work-station market per se. "Work stations don't stand alone," says Richard Lewan, work-station manager for the Maynard, Mass., company. "They're just products in a larger solution for our customers." Also subscribing to this theory is Hewlett-Packard Co., whose widely installed base of minicomputers pulled it into CAD in July 1984 [*Electronics*, Oct. 14, 1985, p. 40].

Along with the coming marketing challenge, there is a technological one facing platform vendors, whose *raison d'être* is to supply the best price/performance ratio. They must figure out how to increase the speed and performance of their systems without significantly increasing price.

Wanted: new ways to boost performance while restraining prices

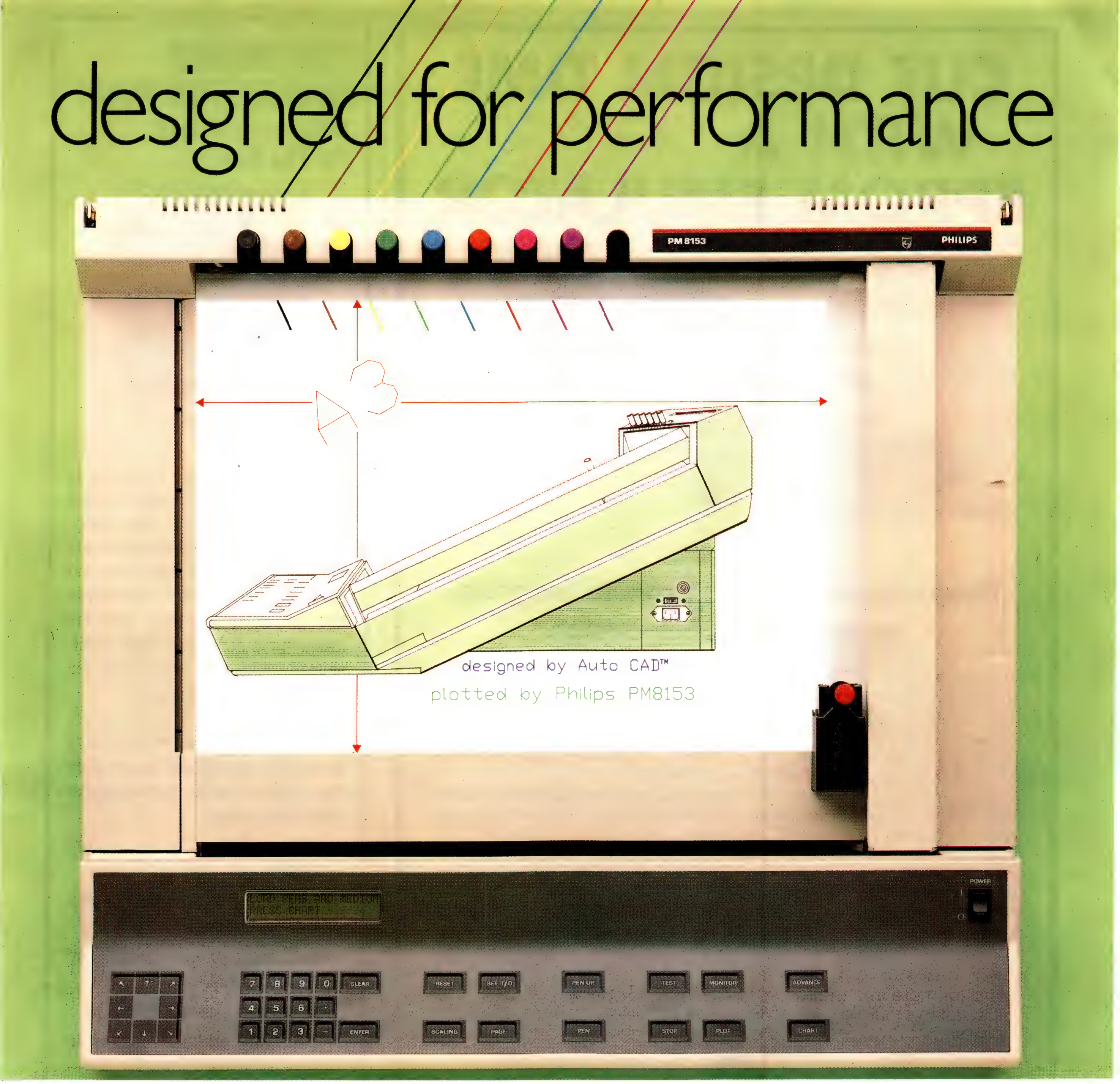
One possible solution is what are being termed compute engines, hot new parallel processors or microprocessor chips that beef up system performance in computation-intensive tasks.

Inmos Corp., of Colorado Springs, which recently announced its transputer, sells an evaluation board containing a transputer chip that fits into an IBM PC AT. This board compiles the same program in 10 seconds on board that takes 5 minutes to compile under MS-DOS. "The board was designed to help people learn how to use the chip without having to build their own boards," says microcomputer marketing manager Brad Hartman. "But it certainly will allow a guy who does the right things with his software to get a bolt-on performance increase."

Sequent Computer Systems Inc., Portland, Ore., can use its parallel processor—part of its Balance 8000 computer—to offload certain tasks. Joanne Kahn, product manager for the Balance 8000, says the company has "some applications where we market as a work-station server, particularly for CAD applications, which tend to be very compute-intensive—even 1 to 2 mips will bog down a work station." For $150,000 to $300,000, Kahn says, work-station vendors can hook up a parallel processor to serve from 2 to 12 32-bit work stations running at up to 8 mips.

As with the tortoise and the hare, however, speed alone will not win the race. "It's conceivable that IBM and DEC will split 50% of the market and leave the others to compete for the other 50%," says Burdick. "The others will have to arm themselves and strengthen their current alliances, as well as find other market uses. But in the long run—three to five years—there'll be no more than five or six companies."

Sun believes that it, DEC, IBM, and Apollo will be the only survivors. "Unless you believe there can be only one computer company in the world—IBM—there will always be an opportunity for other companies to sell computers, especially in the technical market," says Bernard Lacroute, executive vice president and general manager for Sun. "IBM will certainly have an impact. But it won't be the end of it all." ☐



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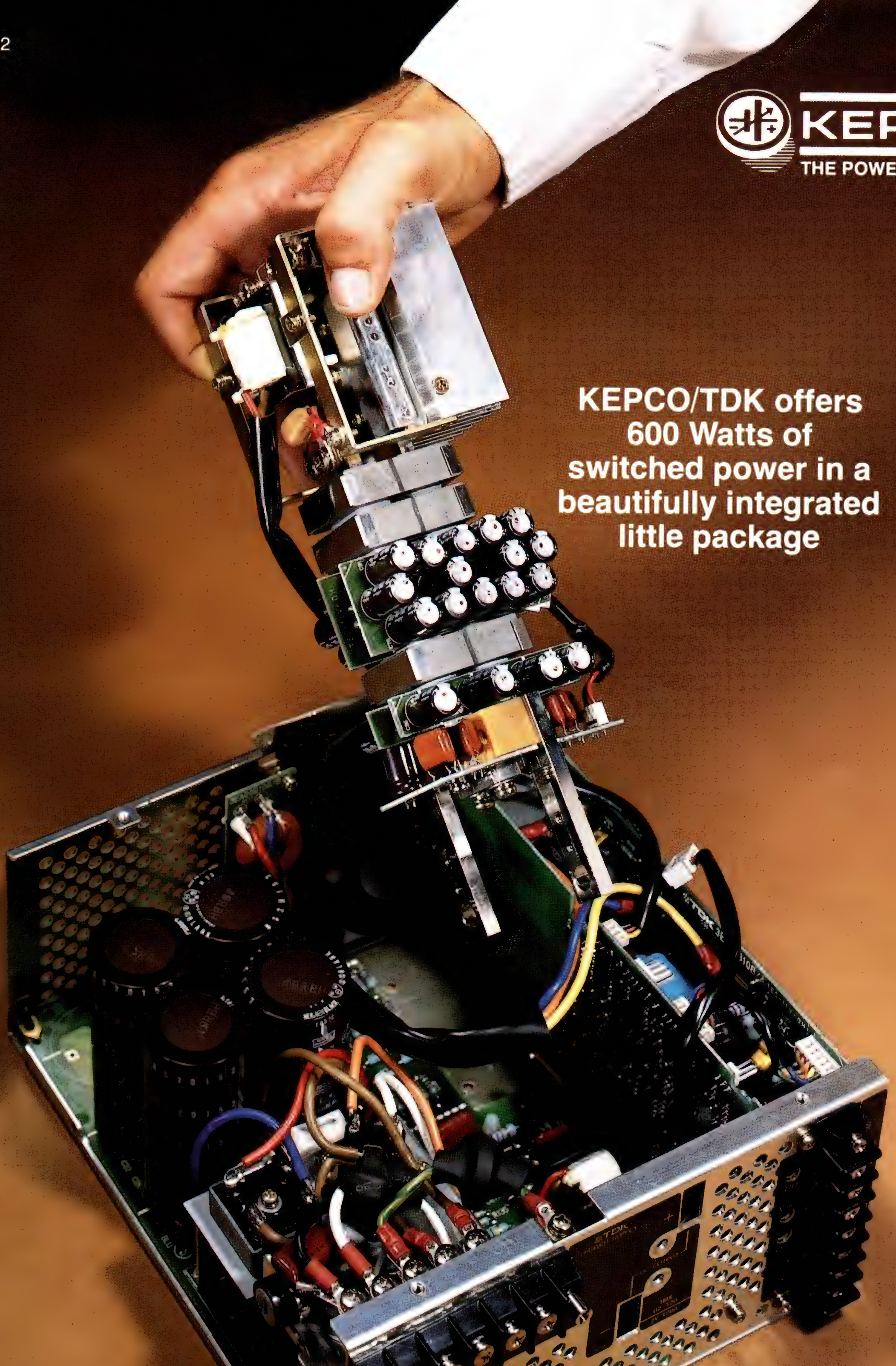

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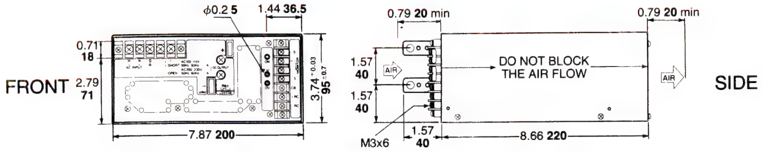
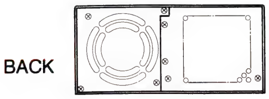
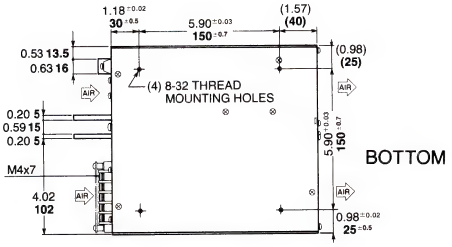
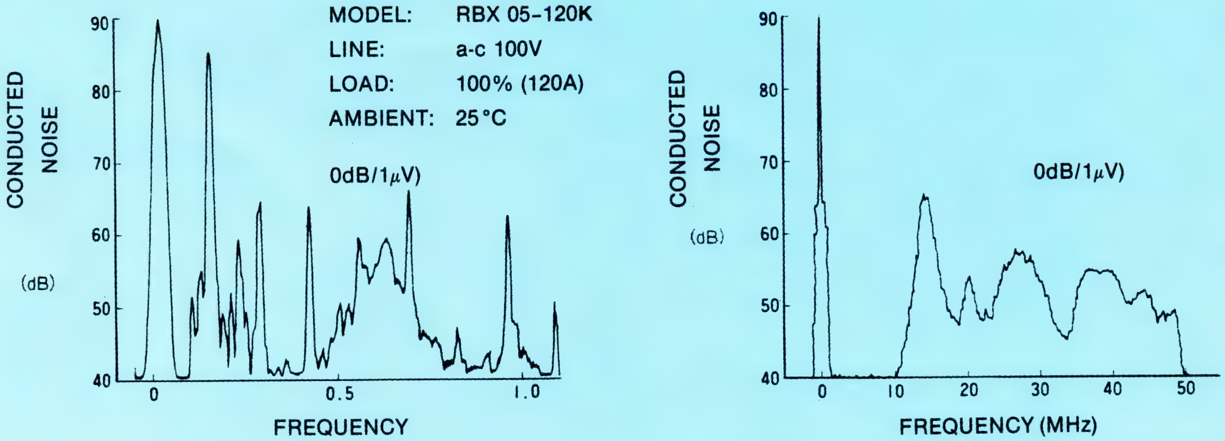


Dimensions in light face type are in inches, dimensions in bold face type are in millimeters.



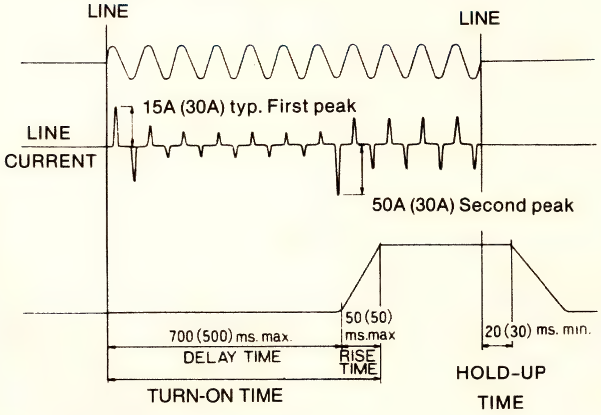


CONDUCTED EMI



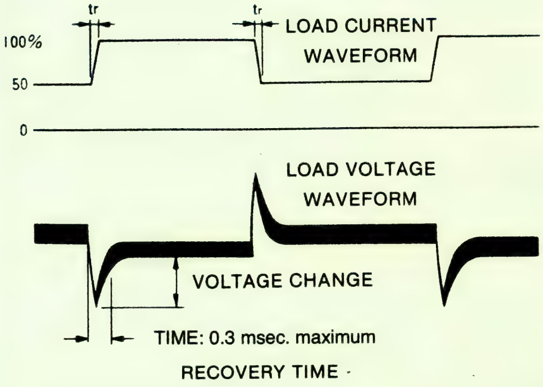
Noise Susceptibility: RBX is designed to tolerate line-borne transients up to 1.5 KV for 1μsec on the 50/60 Hz power mains in normal and common modes.

TURN-ON/TURN-OFF CHARACTERISTICS



TRANSIENT RESPONSE

t_r, $t_f \geq$ 50 μsec.



MODEL	OUTPUT VOLTS	OUTPUT ADJ. RANGE	OUTPUT AMPS	OVERVOLTAGE SETTING*	OVERCURRENT SETTING
RBX 02-120K	2V	1.6-2.2V	0-120A	2.6-2.8V	125-145A
RBX 05-120K	5V	4.0-5.5V	0-120A	6.0-6.5V	125-145A
RBX 24-25K	24V	19.0-26.5V	0-25A	27-27.5V	26-30A

*An overvoltage shuts down the oscillator and sets output to zero. Reset by turning source power off for approximately one second and then back on.

SPECIFICATIONS

MODEL		**RBX 02-120K**	**RBX 05-120K**	**RBX 24-25K**
a-c Input Voltage		115/230V Selectable (85-132/170-264)		
a-c Brown-Out Voltage		80/160V a-c		
a-c Input Frequency		47-440Hz		
a-c Input Power		800VA	1500VA	1400VA
½-Cycle Peak Current at Turn-on		115V a-c: 15A 230V a-c: 30A		
Efficiency		65%	80%	85%
Hold-up Time		30 msec typically, 20 msec minimum		
Output Power		240 Watts	600 Watts	600 Watts
Source Effect: (min.-max. a-c input)	typ	1.5%	0.8%	0.6%
	max	3.0%	1.6%	1.2%
Load Effect: (10%-100% load)	typ	1.0%	0.4%	0.3%
	max	2.0%	0.8%	0.6%
Temperature Effect: (0°-50°C)	typ	0.2%	0.2%	0.2%
	max	1.0%	1.0%	1.0%
Combined Effect:		2.7%	1.4%	1.1%
Ripple & Noise (source & switching components, p-p)	typ	<10mV	<20mV	<25mV
	max	<50mV	<100mV	<100mV
Spike Noise (to 50 MHz, p-p)	max	<100mV	<200mV	<250mV
Time Effect (0.5-8 hr. drift at 25°C maximum load)	typ	0.1%		
	max	0.5%		
Transient Characteristics(1) **50% Load Change**	Excursion	10%	4.0%	4.0%
	Recovery	300 μsec.	300 μsec.	300 μsec.
OVP Adjustment		2.6-2.8V	6.0-6.5V	27-27.5V
Current Limit Setting		125-145A	125-145A	26-30A

(1) If long leads are employed between power supply and its load, a local capacitor at the load may improve transient response and stabilization by providing a local energy storage point near the load.

Operating Temperature: 0 to +50°C

Storage Temperature: −20° to +75°C

Humidity: Up to 85% RH, non-condensing

Vibration: 5-10 Hz, 10mm amplitude,
3 axes; 10-55 Hz, 2g, 3 axes

Shock:
20g, 3 axes, 11 ± 5msec pulse duration

Isolation: 2KV 1 minute input to chassis
2KV 1 minute input to output 500V,
50 MΩ output to chassis

Dimensions:
English: 3.74″H x 7.87″W x 8.66″D
Metric: 95mm x 200mm x 220mm

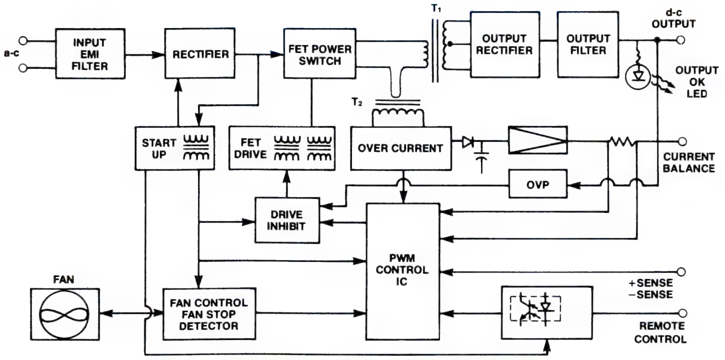
Weight:
9.25 lbs/4.2 kg (5V & 24V models)
8.6 lbs./3.9 kg (2V model)

Frame Material:
Phosphate-treated aluminum

Cooling: Built-in fan (0.8m³/min)

Safety: UL 478, CSA C22.2-154.

SIMPLIFIED BLOCK DIAGRAM



THE BIG BUCKS IN SDI ARE GETTING SMALLER

SOME HIGH-RISK, HIGH-PAYOFF PROJECTS ARE IN JEOPARDY

by Larry Waller

SAN DIEGO

A new electronics industry forecast pulls aside the curtain of secrecy that usually protects the inner machinations of the Strategic Defense Initiative from outside eyes and provides some good news and some bad news. The good news is that the ambitious project is indeed proving a font of new business. The bad news is that budgetary constraints and tough technology challenges are teaming up to force SDI program managers to make some hard research and development choices in coming months.

Major SDI projects are likely to disappear, doomed by congressional action that will undoubtedly slice away at the Administration's funding proposal. SDI program managers also must begin to struggle with long-range problems that could affect the success of the entire effort.

The prediction, part of the Electronic Industries Association's 10th annual Military Electronics Forecast, will draw rapt attention from government contractors, who will use it as a guideline to plan business proposals. More than 200 high-level marketing officials from the military electronics industry attended this month's forecast meeting in San Diego (see p. 23).

As in all EIA forecasts, information was gathered from not-for-attribution interviews with officials of the Department of Defense and Congress and top independent research groups, then assessed by association members with long experience in this business. In the past, this technique has produced market data nearer the mark than any other, most observers agree.

SDI is generating business prospects at an unprecedented rate, say H. A. Beall Jr., director of business development for Rockwell International Corp.'s Defense Electronics Group., and James L. Lee, market analysis manager for Hughes Aircraft Co. In presenting the SDI overview, they emphasized that the business runs across the board and includes communications and weapons research.

What Beall calls "a deluge of SDI requests for proposals" is prompting frenzied reactions from industry. For example, some 18 requests for bids are now circulating with a 30-day response requirement, far less time than the several months normally allowed for companies to polish a bid.

The EIA report notes that SDI is letting so many contracts so rapidly that the project already is taking on an "institutionalized" status. By mid-1986, about 1,000 SDI contracts awarded to small high-technology companies and universities, in addition to major contractors, will give it "tremendous clout" with members of Congress.

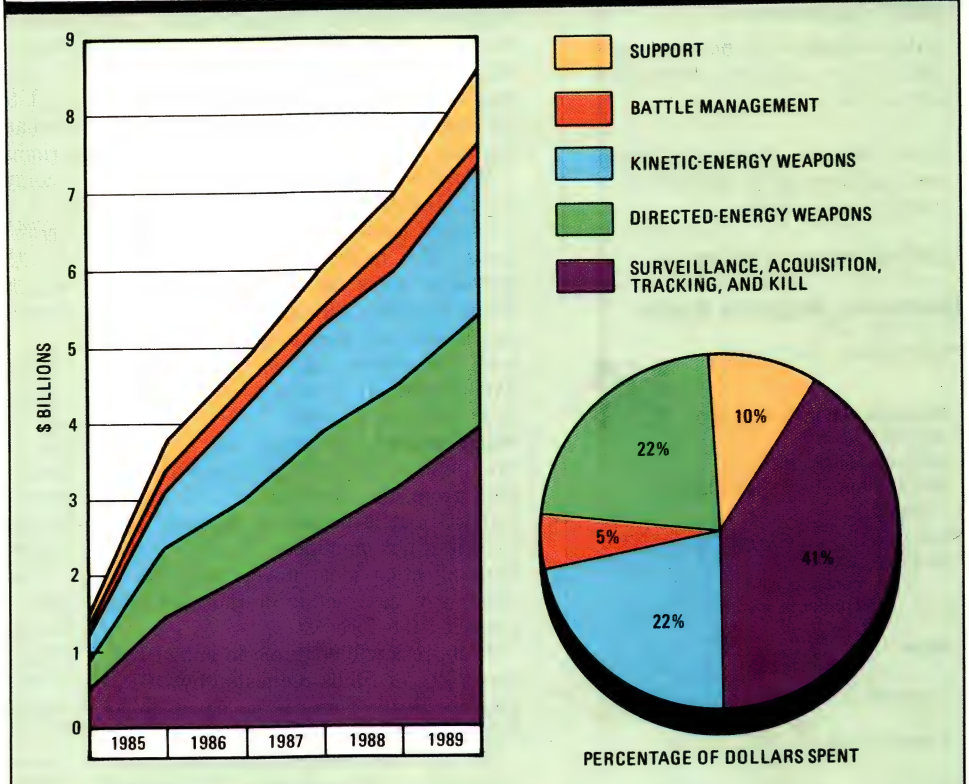
Says Hughes's Lee, who otherwise foresees prospects of generally flat growth in the military electronics industry, "SDI has revitalized the R&D picture for the next five years or so."

Despite the optimistic outlook, some SDI options under development appear to be in deep trouble. The most vulnerable is the active-imaging discrimination satellite, which is part of Surveillance, Acquisition, Tracking, and Kill, the largest program element (see figure).

A U. S. Air Force development task with a contract held by the Massachusetts Institute of Technology's Lincoln Laboratory, the satellite is intended to pick out real enemy warheads from among decoys during the post-boost and mid-course trajectory phase. It will employ either laser or radar sensors.

Lee terms the imaging satellite a "high-risk, high-payoff" project whose

SDI PROGRAM ELEMENTS SOAR



SOURCE: ELECTRONIC INDUSTRIES ASSOCIATION

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HOW INTEL AIMS TO REGAIN MOMENTUM

COUPLES 32-BIT MICROPROCESSOR WITH COMPANY REORGANIZATION

by Clifford Barney

SANTA CLARA, CALIF.

Dave House has been enjoying himself lately. After living for nearly two years under the shadow of his company's tardiness in developing a 32-bit microprocessor, the vice president and general manager of Intel Corp.'s Microcomputer Group has some sensational new promotional material. At sales meetings, he will casually open a plastic case and offer it to a customer. Inside is a wafer with 55 integrated circuits, each 1 cm^2, etched into the surface. The chips are the first samples of Intel Corp.'s 80386, its 32-bit top-of-the-line architecture—a day late, perhaps, but far from a dollar short.

"They haven't known that we've got parts," says a grinning House. "Most of them close the case right away and put it on the table [as though it were fragile]. I open it up again."

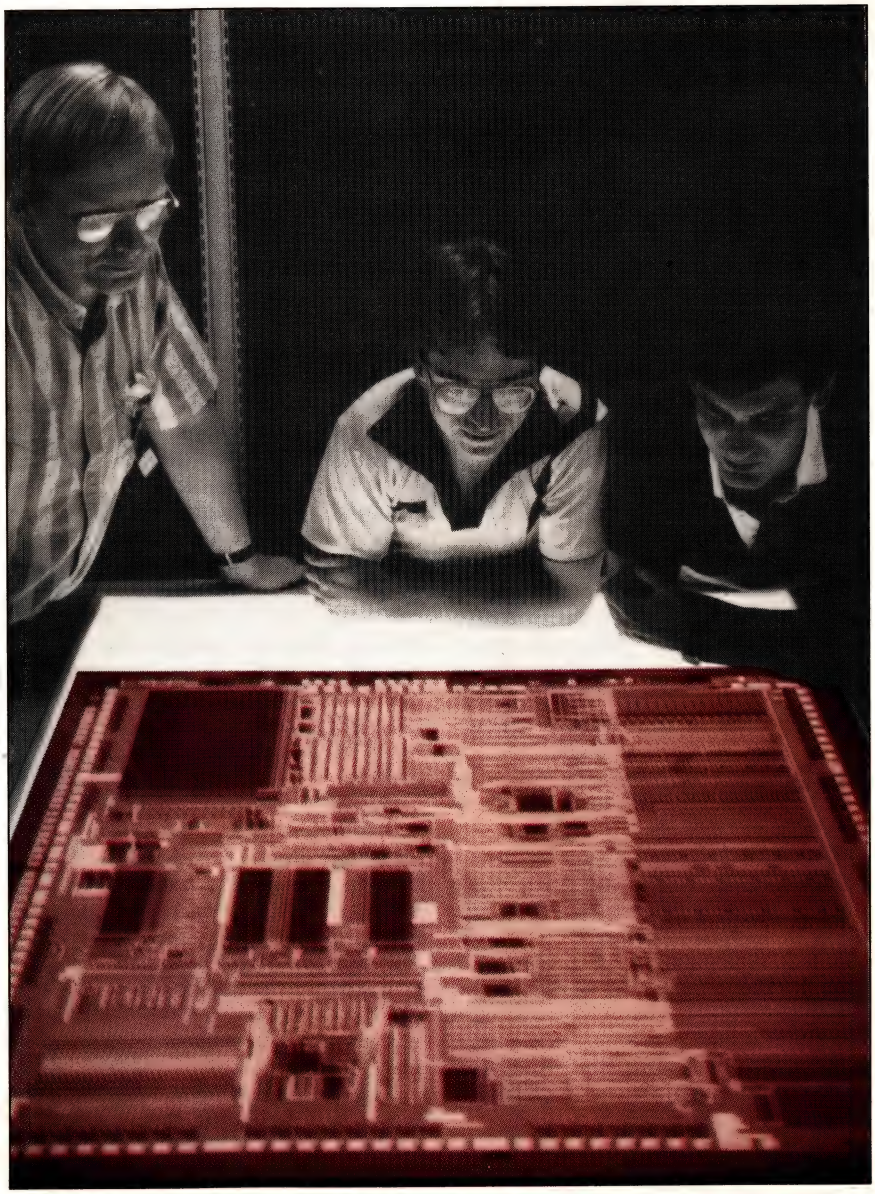
House likes to display the evidence that Intel is ready to shed its embarrassing position of being simultaneously a self-proclaimed leader in advanced designs and a laggard in the 32-bit sweepstakes. AT&T, Motorola, National Semiconductor, and even the lightly regarded Fairchild Camera & Instrument managed to introduce 32-bit processors well before the chip maker that started it all.

Intel is getting into ASICs and out of the DRAM business

Still, microprocessors are hardly Intel's chief concern at present. Though it is unveiling the 386 with great fanfare, Intel has been struggling to survive the industry slump. It is facing—and making—major strategic decisions about products, marketing, and manufacturing. In particular, it is planning to get into the growing market for application-specific ICs—and has decided to get out of the dynamic random-access-memory business.

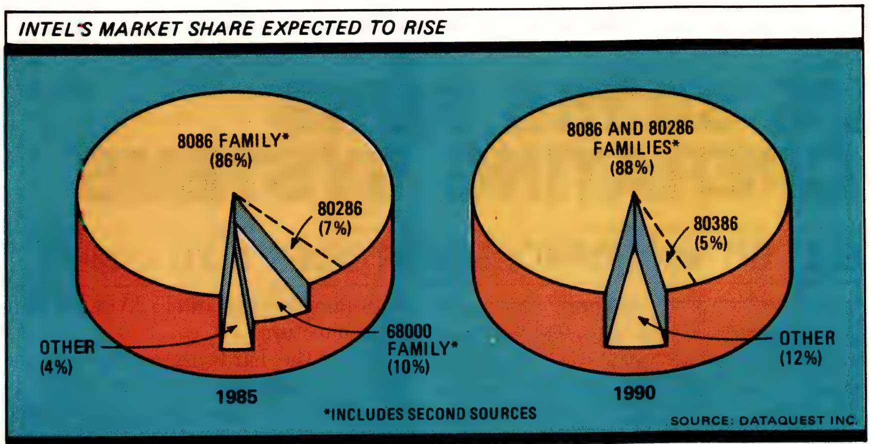
But Intel, which dominates the 16-bit microprocessor market, has now made its move in the 32-bit race, like a favorite moving up in the backstretch after failing to show early foot. Dataquest Inc., the San Jose, Calif., research company, pegs the 32-bit-microprocessor market at only $17 million this year, indicating that the race still has a way to go. By the time the market reaches Dataquest's projection of $195 million by 1990, House says, he "conservatively" expects Intel to have half of it. And peripheral chips, he adds, may double the market size.

Intel is solidly positioned in microprocessors because of the pervasiveness of its architecture. Chips based on the 8086 family—made largely by Intel but including those produced by second sources—will account for 83% of the mi-



CHECK. Intel designers Jan Prak, Pat Gelsinger, and Chip Krauskopf study 80386 mask.

INTEL'S MARKET SHARE EXPECTED TO RISE



SOURCE: DATAQUEST INC.

Moore. However, Intel still has no gate-array capability, and its design tools, while powerful, are anything but user-friendly, Carsten concedes.

In the meantime, at least part of the reorganization is taking shape as Intel attempts to shore up its manufacturing process. Long known as a technology leader, Intel stumbled badly when it attempted to build the industry's first 6-in.-wafer production line at its $100 million Fab 7 plant in Albuquerque, N. M. By the time yields were acceptable, the 1984 boom had passed.

Intel is spending about $270 million on capital improvements this year. Next year's spending will depend somewhat on the market; Moore says 1986 sales still will not match 1984's and that the capital outlay may drop to $250 million.

In the same reorganization that put Carsten in charge of ASICs, Intel has pulled together manufacturing, assembly, and packaging in a single group structure. Craig Barrett, the group's vice president, is charged with improving Intel's manufacturing yields while paring costs to the bone. Barrett has already announced plans to squeeze the most he can out of Intel's current manufacturing facilities, while retaining the capability of increasing capacity as much as sixfold between now and 1990.

COST CUTTING. Costs will be cut by subcontracting as much work as possible, reducing inventories, and keeping a tight rein on manufacturing. Fab 7 will be the workhorse facility and is expected to be Intel's biggest by the end of the year. Another 6-in.-wafer line in Israel will start up this quarter. And a twin of Fab 7 in Albuquerque will be mothballed when its shell is completed, for activation when demand requires it.

Yields must be improved while costs are cut

Intel went through several iterations testing out new fabrication equipment at Albuquerque. Visitors who have seen the new fab area report that it is now proceeding cautiously and sticking to known processes, rather than pushing the state of the art.

Like everyone else in the industry, Intel is moving heavily into CMOS, which will account for 60% of its volume by the end of next year. All CMOS will use 1.5-μm design rules or below by 1986, and 20% of Intel's production will be 1 μm in 1986, Barrett says.

The move into ASICs, a market in which there are many designs with a limited demand for each, represents a complete change from Intel's original position as a supplier of commodity products. When Moore and Robert N. Noyce founded Intel in 1968, they looked for large applications to exploit the then-new MOS memory technology. That direction is no longer a valid strategy for a U. S. chip manufacturer, Noyce now believes.

"The very significant advantage our foreign competitors hold, because of the value of the dollar, is forcing us to rethink all of that," he says. When Intel this month announced that it would stop making DRAMs, a technology that it originated, it was further evidence that the DRAM market has been hard hit by price cuts this year. Intel has lost market share to the point where DRAMs account for only 5% of its sales.

Intel has joined with Advanced Micro Devices Inc. and National Semiconductor Corp. to protest what it insists is Japanese dumping—or selling below cost—of semiconductor products in the U. S. [*Electronics,* Oct. 7, 1985, p. 14]. But when asked to discuss the Japanese threat as featured speaker at last month's annual Semiconductor Industry Association dinner, Noyce focused his talk not on Japanese trade practices but on the crippling effects of a 50% increase in the value of the dollar since 1980.

SOMETHING EXTRA. "Intel would have no trouble competing with U. S. companies," Noyce says. "But when your competition has a major cost advantage of 30% or 40%, you have to provide something else that the competition can't."

In Intel's case, Noyce says, that means supplying highly complex circuits, a software base, design aids, and eventually the use of ASIC building blocks and peripheral processors for functions that are not easily obtained elsewhere.

But beyond that, he says, "there is no question that the U. S. semiconductor industry has a community of interest against foreign competition." Putting his mouth where his money is, Noyce has for the past five years divorced himself from day-to-day operations at Intel to lobby for the entire U. S. industry.

Getting outside the U. S. dollar base by manufacturing abroad buys some time for U. S. companies, Noyce says. But in the long run, they will have to come to terms with what he calls "societal overhead"—the raw demands of a given society.

"It now becomes a competition between the productive efficiencies of the different societies," Noyce says. "That can swamp the advantage of being good. Excellence in one company isn't enough. Excellence in a whole society becomes dominant, because you have the drag of what the rest of the society is doing to worry about.

"How do we support those 50,000 new attorneys every year? How do we support the overabundance of MDs in our country? The more the manufacturing base shrinks, the more the societal overhead is piled onto a smaller and smaller chunk of the wealth-producing side."

These are all things that Intel as a company can't do much about, Noyce concedes. "We'll be more conservative," he says. "We'll broaden our horizons into systems. But in the long run, all we can do is make our contribution." ☐

SPOKESMAN. Robert N. Noyce, an Intel founder, now lobbies for the whole industry.

potential customers will be intent on learning whether its advanced design can be readily harnessed to produce real-world applications. The chip's ability to simultaneously run applications programs written for different operating systems allows any combination of the PC-DOS, MS-DOS, Unix, or Xenix operating systems to control concurrent applications. In addition, proprietary operating systems created for the chip can be used. Multiple execution will be particularly important in two key markets—work stations and office automation. It also makes the 80386 ideal for applications in computer-aided design, robotics, and embedded systems.

For example, an 80386-based engineering work station might run a scientific program under Unix and an MS-DOS word-processing application at the same time. The system's user could then view and control both functions by means of a screen-windowing feature. Previously, such a setup would have required a separate work station and a personal computer. Even then, it would be less flexible because data could not be transferred back and forth between the applications.

Other possible applications include industrial control systems performing both factory-floor functions and generating reports with the aid of standard office-automation software. A third use involves moving proprietary minicomputer applications to new 80386-based microcomputers using standard compilers. These microcomputers could then run programs developed for, say, a Digital Equipment Corp. VAX or Data General Corp. minicomputer together with a huge base of personal computer software.

SOUL OF THE NEW MACHINE

A primary objective during the chip's design phase was the ability to tie together the dual features of multiple execution and upward compatibility as seamlessly as possible, says Leglise. Nailing down the implementation required a break from previous design approaches.

Multiple execution requires multitasking—a technique for managing a computer system's workload when that work consists of multiple activities. A multitasking operating system simulates multiple processors by providing each task with a virtual processor. At any instant, the operating system assigns the task on the real processor to one of the virtual processors. To maintain the illusion of one processor per task, the operating system frequently switches the real-processor tasks to a different virtual processor. In a typical 32-bit system, providing multitasking support involves the switching of about 70 to 80 words of 32 bits each, saving them in memory, and retrieving them when needed.

Most 16- and 32-bit chips implement the advantage offered by multitasking in software. With the 80386, Intel took the novel tack of incorporating this capability on the chip—that is, in hardware. The result is a performance improvement of about 10 : 1 over the software-implementation approach.

When the 80386's operating system decides to switch tasks, it issues a single instruction. "Instead of the operating system executing a hundred or so instructions to set some tables or save the contents of the machine, bring in a new context, and load the registers, this is done with a single instruction in 17 to 20 μs on a 16-MHz 80386, with no wait states, versus about 200 μs when done in software," says Leglise.

Additional design decisions took up any possible slack in the upward-compatibility feature. For the smoothest performance, the 80386 was given two separate modes of execution: real mode or virtual-86 mode. When running in real mode, the 80386 provides an environment for fast execution of 8086 programs. In effect, it presents the software with an 8086 chip, so existing 8086 programs can run as if they are executing on the original hardware. The 80386 actually runs much faster than the older 8086. Sometimes, this necessitates minor modifications to the original software.

Virtual-86 mode establishes an 8086 execution environment within the 80386's protected multitasking environment. This mode allows an operating system to support concurrent execution of 8086, 80286, and 80386 programs. In virtual 86, 8086 programs "see" an 8086 chip, while the microprocessor operates normally for 80286 and 80386 software.

HANDLING DISRUPTIVE INSTRUCTIONS

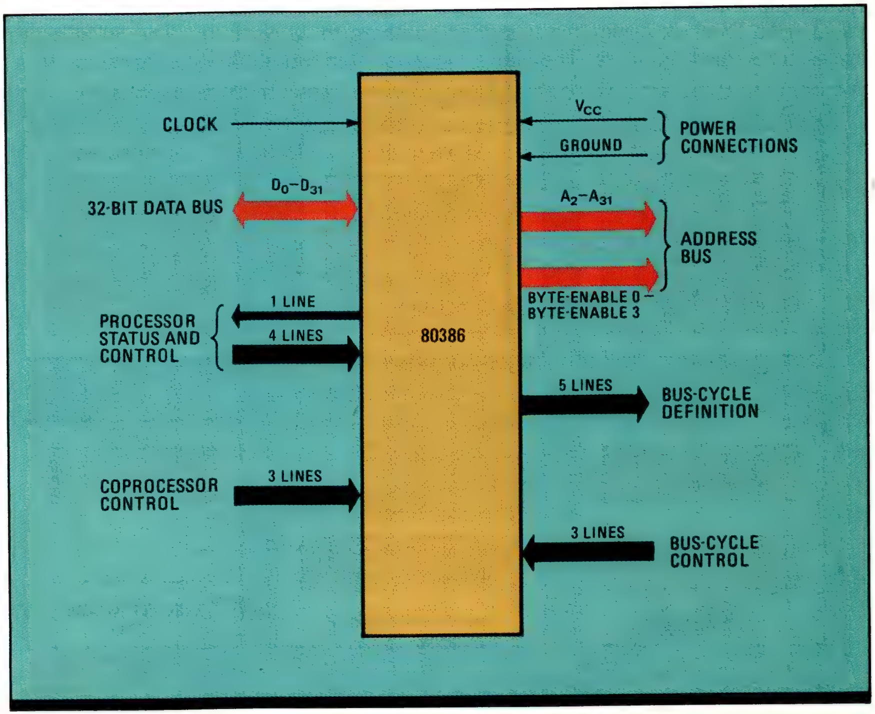
However, a problem crops up in attempting to run side-by-side programs that may have been written originally for single-task execution. These single-task programs may contain instructions that are potentially disruptive if executed in a multitasking, or concurrent, environment.

For example, a program may contain a clear-interrupt-flag instruction, which could bring the entire system to a halt. To prevent this, the 80386 raises an exception whenever a virtual-86 mode task attempts to execute an input/output or interrupt-related task. This feature invokes a special exception handler, which bypasses the problem by simulating the forbidden instructions in a form acceptable to the 80386.

More often, however, no recompilation or reassembly is necessary to use most applications software written for earlier members of the iAPX family. Exceptions might exist for software that is speed- or I/O-configuration-dependent, but the majority of the software will run unchanged.

The same is true of operating systems. "About 95% of the 80386 instructions are bit-compatible with the 8086. The only exceptions are the 5% or so that involve system calls and I/O routines," says Leglise. "At most, this will require the addition of a shell consisting of no more than 500 to 1,000 lines."

The multiple-execution environment and upward compatibil-



2. INS AND OUTS. The 80386 features separate 32-bit address and data buses. Initial versions will run at 12 or 16 MHz, driven by a clock signal that is twice the frequency of the chip. Typical status, bus, and power connections round out the package.

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Robots get Smart in Japan

ITT Invests in European Units Crack U.S.

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Europe's Esprit Finally Sets Sail

LSI Logic Counts on Sandfort to make its Mark in Europe

Upstart Vendor Makes Waves in Japan's Robot Market

NEC Fashions New Fab Process

Olivetti's Viti Directs ET Designs that Marry Bus & Art

German Startup's Success Surprises Europeans

Britons Seek Tolerant Chips

OBI Rains on IBM's Parade

Mega's Friedrich Aims to Cut Asian Lead in Memories

March

British GaAs Chips Go to Market

NEC's CPU Leapfrogs IBM

Hitachi CPU Challenges IBM

France's Lansat Rival Set for Fall Launch

Olivetti Stakes Claim in Video Typewriters

Italian VLSI Chip has the Right Accent

Koreans Try for VCR Replay

Germans Push X-ray Exposure

There's Life in Resistors, German Company Finds

UK Beats a Path for Europe's Race

April

German System Meets New ICAO Standard

West Germans Squabble Over Choice of IFF

Britain Promotes Open Architecture

US Makes Progress in Japan Telecom Talks

Japan's Lead in Optical Disks: It's Part of the System

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May

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ICL Banks on Networks and Japanese Chips

Min Blazes Bright Path for Korea's Gold Star

Asia: The Four Dragons Rush to Play Catch-up Game

Singapore Casts Lot with Software

Philips' Eurom Chip Finally Debuts

Sagging Prices Sting Japanese Producers

British Telecom Spreads Its Wings with Mitel

South Korean IC Maker Seeks World Markets

June

Plessey Switches Off Flash ADC, Saves Power

Sony Campaigns Hard for BMM Camcorders

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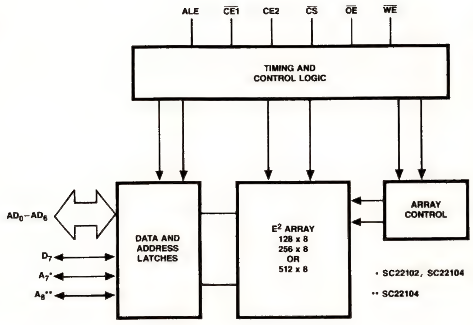

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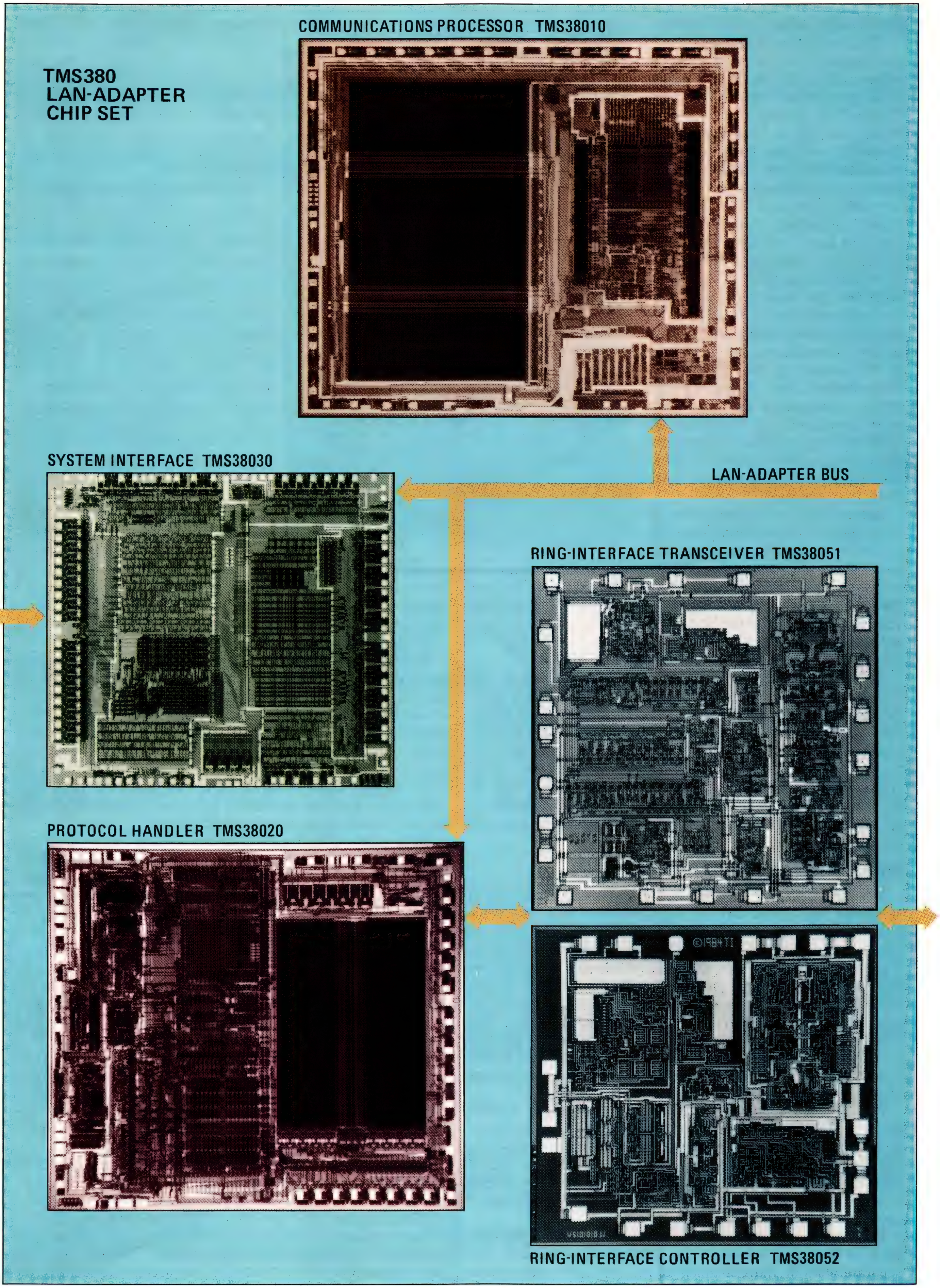
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PROTOCOL HANDLER TMS38020
RING-INTERFACE CONTROLLER TMS38052
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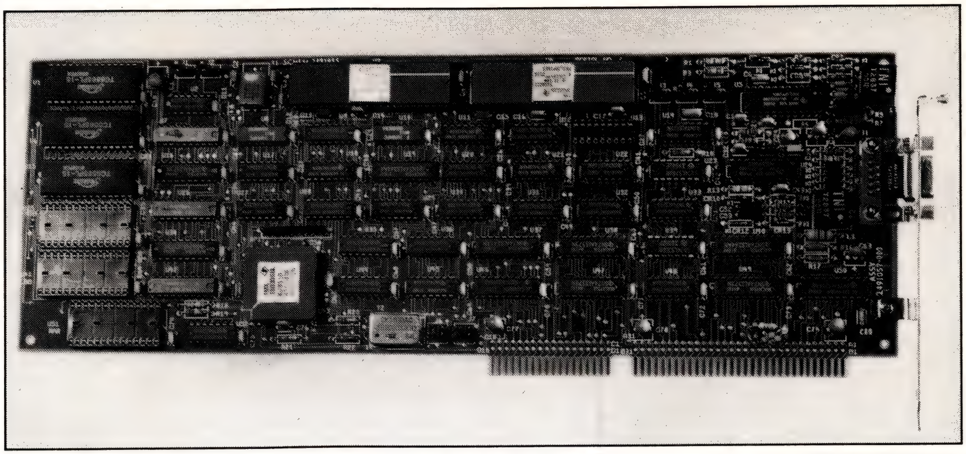
second unsupported MAC frame, so it is not listed in the table.

Not all the net-management MAC frames will be used in small configurations of the token-ring net. For example, a small personal computer net may not have a designated network manager. Though the TMS380-based adapter cards will continue to transmit all of the MAC messages, small nets will need only the six original IEEE frames plus two added ones—lobe-media test and response. The 19 other MAC frames will continue flowing through the token-ring cables unused, and they will always be available whenever an installation using a Token Ring Network or compatible net is expanded, says Hughes.



2. TRYOUT CARD. A development board for the IBM PC AT lets TI customers try out the TMS380 IC. It includes EPROM sockets for additional protocol handlers that enhance the basic chip set's functionality.

The network-management MAC frames are intended to provide messages and information to application software, which could be running inside any of the attached nodes. If an attached computer can use the net-management information, the frames are "functionally addressed" to the stations—that is, only a station performing a particular function will take note of the applicable frame. The application software, developed by system houses, LAN-equipment integrators, and software suppliers, could then be used to analyze net performance, compile error reports, and even try to fix problems.

The addition of the MAC superset affects data throughput only slightly, according to TI. If a ring had no net manager and most of the MAC frames were not used, the overhead would be around 0.929% of the system's theoretical top speed. The low overhead is primarily the result of the 7-s intervals between sweeps of the ring poll timer—one of the critical timing parameters IBM and TI have kept secret until now.

The chip set can be a building block for high-level protocols

The benefit of having all the MAC frames present in even the smallest system is total compatibility for TMS380-based equipment whenever the network is expanded, says Templeton. "The problem with LAN management today is each vendor has had to bear the cost of development, and the worst part is that implementations end up incompatible, not because they are better or worse but just because they were done differently."

The superset of MAC frames is just one of several features embedded in the chip set to ensure what IBM calls RAS, for reliability, availability, and serviceability. The others are cabling-system fault isolation, self-testing diagnostics, automatic verification of frame delivery, error logging and reporting, and hard-error fault isolation and recovery.

To aid in isolating cable faults, the chip set detects and reports to its host any shorts or breaks in the attachment to the network cable as well as degraded signaling characteristics of the lines to the wire center (the point of connection to the ring). Fault conditions can be isolated at either the attached product or wire center.

Self-testing is performed from 3-K bytes of software in the 38020 protocol handler's ROM. The adapter card sends a 2,000-frame test message on the link to the wiring center, and this message must check out before it is allowed to insert itself on the network. Automatic verification of frame delivery is provided on all transmitted frames. Each sending station gets a status report on every frame it sends. The chip set handles error logging and reporting with nine 8-bit counters that will record errors on a log for the host CPU. Also, it will send error reports over the LAN about every 2 seconds. If a monitor of ring errors is residing on the network, it will be able to collect those reports from the MAC frames.

Fault isolation and recovery automatically enable the LAN adapters to collectively narrow down where a glitch is occurring. The LAN system then attempts to fix the problem with minimum disruption in service, according to TI. It is at this point that many other implementations of IEEE-802.5-compatible token rings might be excluded from the network, says Hughes, who maintains that the only way to achieve 100% IBM-compatibility is by using all five TMS380 chips.

"The on-chip RAS implementation comes about from software code integration in ROM and features in the hardware. It is not on any one chip," Hughes notes. For example, the bipolar chips have analog circuits that detect wiring faults with energy detection. Error-checking circuitry is included on the chips for bit parity over the LAN-adapter bus.

All that is needed to design a fully IBM-compatible adapter are the five TMS380 chips; standard glue logic for interface to the host-system backplane; transformers for electrical isolation of the ring interface to the cable; diodes for lightning protection; passive components to establish the characteristics of the line equalization; and a phase-locked loop for capture and recovery of signals.

TI is offering adapter-card customers two development boards to quickly try out the chips and the embedded networking services. One development adapter card (Fig. 2) is for IBM's PC AT; the other is for computers with 8-bit-wide buses. The AT adapter board contains additional RAM to buffer networked data on the board's 48-Mb/s bus. It also has sockets for erasable programmable ROM, which can expand on the software embedded in the 16-K bytes of ROM in the 38020 protocol-handler chip.

ADDING FUNCTIONALITY

These expanded protocol-handler programs will enable the 38010 communications processor to do additional high-level protocol conversions, reaching into the upper layers of the seven-layer ISO model. These programs feed to the communications processor from the EPROM over the LAN-adapter bus.

"With more development work, some of our experienced customers can turn the chip set from a level 2 to a level 6," says Templeton. "That ends up putting a lot more functionality into the adapter and offloads more from the host." TI declines to identify what protocols are in the works by customers, but likely candidates for higher-level conversions include such widely used networking schemes as IBM's SNA, TCP/IP, Digital Equipment Corp.'s DECnet, Xerox Corp.'s XNS, and even IBM's Netbios for personal computers. ☐

The problem has been around for years.

Every country in Europe has its own, special technical requirements for two-way radio broadcasting. As a result, electronics manufacturers have been hard-pressed to find a way to bring the advantages of volume production to this category of products.

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noise and delay—to snatch away market share.

Satellite communications has already suffered from launch problems this year. And because improvement in technology is decreasing receiver sizes, providers of direct broadcast services are having to erect defenses against viewer-pirates.

LAN makers talked for years about the need to standardize their products. Then General Motors Corp. gave them a shove, and now manufacturers find themselves poised for serious action. GM's Manufacturing Automation Protocol for IEEE-802.4 token-passing bus networks is destined to have a profound impact on network interoperability.

MAP is a published set of GM specifications based on the seven-layer International Organization for Standardization's open-systems interconnection reference model, which uses existing and emerging standard communications protocols for multivendor data communications. Besides its obvious importance to America's hard-hit smokestack industries, MAP represents one of the few examples of users pushing hard enough to speed up the snail's-pace politics of standards making.

MAP is speeding up the politics of standards making

GM has the data-processing and automation budget to make an industry standard happen. The vendors—having long paid lip service to interoperability while rejoicing in proprietary solutions to keep a lock on market share—are starting to fall into line. Soon IBM, Hewlett-Packard, Honeywell, Digital Equipment, Allen-Bradley, Gould, and a host of other big-name automation vendors will be incorporating a single, standardized, MAP-approved 802.4-token-bus implementation into all the robot work cells and numerically controlled machines they sell to General Motors.

PICKING UP SPEED

Announcements of the communications controllers for the MAP network are starting to come fast and furious. Concord Data Systems Inc., which GM tapped initially to provide its Token/Net communications for the landmark demonstration of MAP at the July 1984 National Computer Conference, is working with Gould AMI on a three-chip, very large-scale-integration implementation. Motorola Inc. announced its VMEbus MAP network interface, which is a two-board set for VMEbus form factor, as well as a token-bus controller chip called the MC6824.

Intel is readying a $3,750 communications board built around a Multibus-I architecture, an 80186 central processing unit, and a broadband modem that can grab any of the three 12-MHz channels in the 400-MHz link. Intel is also reported to be working on a controller chip meant to replace the board-level solution with a single VLSI device.

Industrial Networking, a joint venture of Ungermann-Bass and General Electric, worked with Toshiba to develop two CMOS gate-array chips that handle physical- and data-link chores for MAP. These chips will be folded into board-level products, which in turn will meet the input/output requirements of the devices into which they are incorporated.

In the world of office communications, Boeing Computer Services Co.—a division of the Seattle, Wash., airplane manufacturer—is trying the same trick for IEEE-802.3 networks, which use collision-sense multiple access with collision detection. But since its introduction as the proprietary Ethernet several years ago, the "standard" 10-Mb/s CSMA/CD has surfaced in so many versions that a single version with interoperability seems impossible. The simple truth is that there are an estimated 200 vendors of local-net products, and most of the products that they offer are incompatible.

Yet interoperability is not impossible. Bridge Communications Inc. offers just such a system for the Ethernet tangle and has prospered because of it (see "Bridge Communications' Estrin: born to compute," p. 68).

The system from the Mountain View, Calif., company comprises communications servers capable of 1-Mb/s protocol processing between Ethernet, IBM Corp.'s Systems Network Architecture, and Unix 4.2bsd hosts, and a line of gateway servers that performs protocol translations among XNS, X.25, and High Level Data Link Control synchronous protocols.

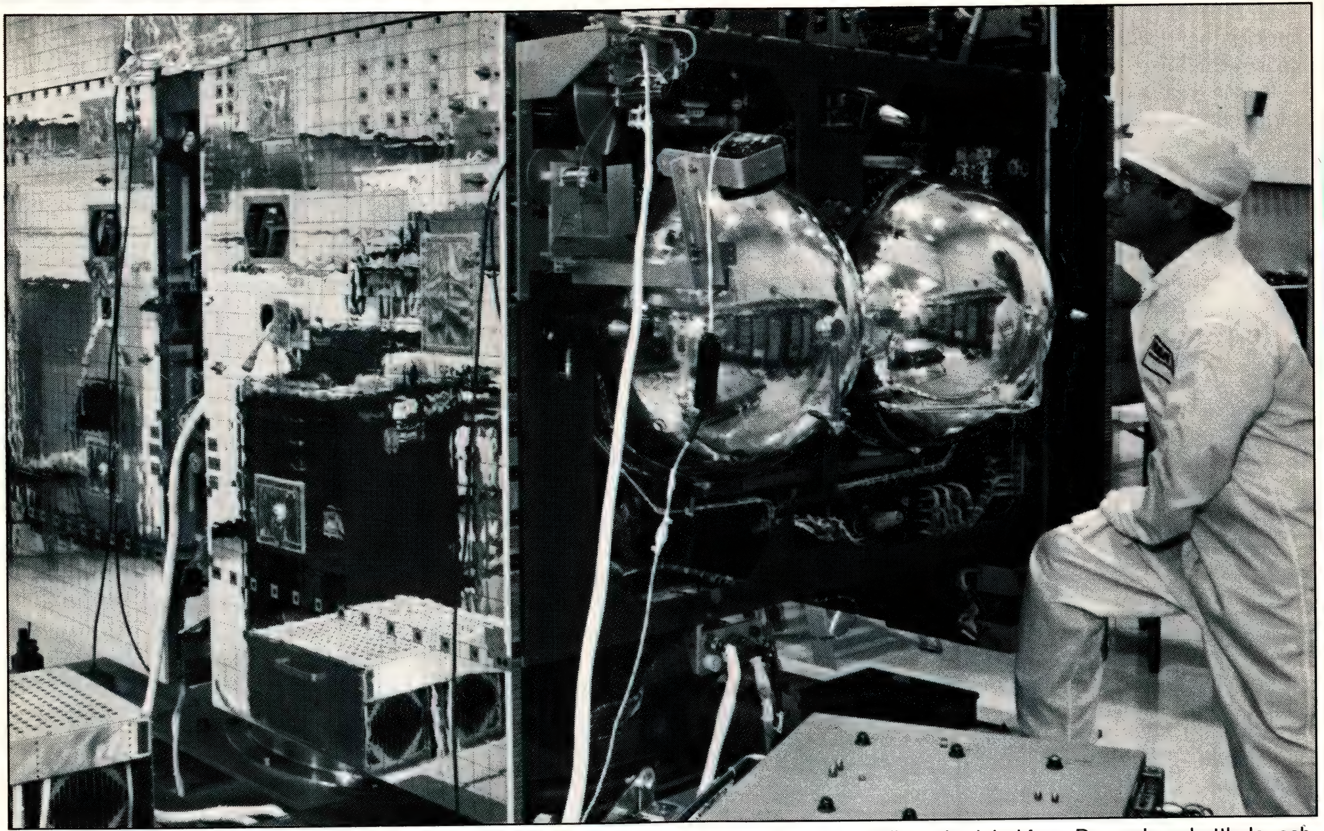
Incompatibilities will bedevil versions of IEEE-802.3 networks for some time to come. A big question following IBM's announcement of its 802.5 token-ring network, however, is whether other vendors will be able to offer board-level products that conform to IBM's token ring.

Since IBM first showed the token ring at the Telecom/83 conference in Geneva, Switzerland, the system has become equated with IBM's plans for distributing intelligence across the network. Texas Instruments, chosen by the computer manufacturer to develop the five-chip set upon which the communications product will be based, is already supplying the chip sets to various vendors and is reported to be providing help in developing the protocol software.

But vendors that are attempting to provide IBM-compatible systems will have trouble unraveling IBM's proprietary network management and diagnostics. The computer giant has developed a superset of the IEEE-802.5 specification to handle those functions for its proprietary network architecture, and it has loaded them into 16-K bytes of read-only memory on the protocol handler of the five-chip LAN adapter.

LAN manufacturers are providing much of the technical innovation for integrating voice and data in a single switch,

LASERWARE. Switches fabricated from optical bistable devices promise subpicosecond speeds, making optical computing and superfast serial switches a reality. Bistable materials are currently under development at GTE, Stamford, Conn.



K_u-BAND BIRD. RCA Astro-Electronics engineer Robert Cenker will accompany K_u-band satellite scheduled for a December shuttle launch. The smaller receiver required for K_u-band receivers is one factor that will effect the commercial success of direct broadcast satellite services.

acteristics, which cause pulses to spread and overlap, producing signal interference.

Dispersion is a result of the signals propagating along different paths or modes. Some modes run parallel to the axis of the cable; others remain just within the angle of incidence of reflection at the core-cladding boundary; still other modes pass into the cladding.

Modal dispersion occurs because modes with a high order of incidence must travel farther along the fiber than modes that run parallel to the axis, affecting the distance that a signal can be transmitted before regeneration. By varying the refractive index of the fiber with that of the core, graded-index multimode fiber compensates for some of the dispersion.

The multimode fiber that is installed along the Northeast corridor transmits at 90 Mb/s with repeaters that are spaced 7 km apart—roughly following the spacing of repeaters in copper network. Aluminum gallium arsenide semiconductor lasers emitting a wavelength near 0.82 μm are used as the light-emitting source to drive the signals.

LAN functions are tightly coupled to new PBX switches

SINGLE-MODE FIBER COMES OF AGE

Since 1983, single-mode fibers have come into their own on almost all long-haul routes, because the quality of available light has changed. The source for these third-generation fibers: indium gallium arsenide phosphide semiconductor lasers, which operate at a longer wavelength (1.3 μm) with lower loss and higher bandwidth than the previous generations. Present single-mode fiber transmits 400 Mb/s, with a distance of 25 km between repeaters and a maximum attenuation of 0.5 dB/km.

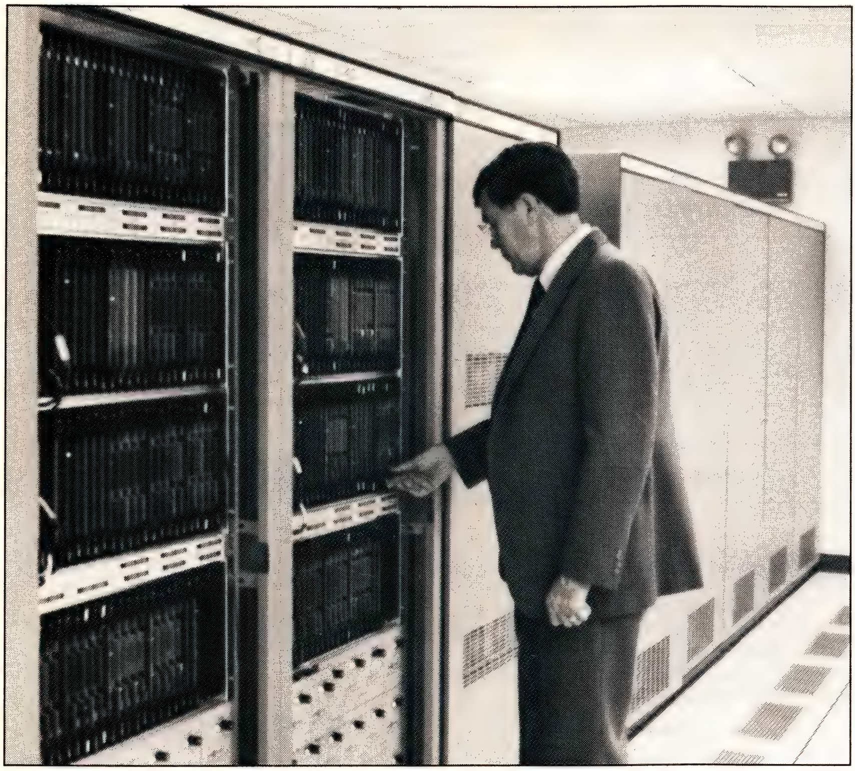
And single-mode fiber shares none of the modal dispersion characteristics of multimode fiber, since a much smaller core (typically 5 to 8 μm) makes spreading impossible. Though the much smaller diameter of the lightguide core makes single-mode fibers more difficult to splice, the wide spacing of repeaters makes it the favorite for long-distance communications.

Single-mode fibers operating at near-infrared wavelengths of 1.3 μm work close to the wavelength of minimum dispersion, but much research is under way to shift the operating wavelength to 1.5 μm, where attenuation is also at a minimum.

Corning Glass Works, Corning, N. Y., is acknowledged to have the lead in manufacturing such dispersion-shifted fibers, and is beginning volume deliveries. But Sumitomo Chemical Co. is not far behind; the Osaka, Japan, manufacturer plans to begin production next year. When these fourth-generation fibers are finally buried, they will make it possible to push more than a gigabit per second across the network, with repeaters that are spaced as far as 150 km apart.

In short-haul data communications, more fiber than ever is being pulled in new and existing buildings—even though the building's designers and tenants sometimes lack specific plans for using it. Fiber's boom in the absence of a clear focus owes to a bandwagon effect: more than a year ago, IBM Corp. and AT&T Co. blessed the idea of fiber-optic premise distribution systems with their own schemes tied to their local net offerings. Both IBM's cabling scheme and AT&T's Lightguide system are modular, centered on cross-connect cabinets mounted in wire closets.

IBM's announcement of its 3044 Fiber Channel Extender is only a halfhearted endorsement of fiber's important role in low-cost peripheral sharing. Honeywell Inc.'s Optoelectronics Divison, Richardson, Texas, will soon introduce a low-cost, RS-232-C-compatible fiber-optic link for commercial markets. Meanwhile, Raycom Systems, Boulder, which



BIG SWITCH. PBX architectures are being modified to handle voice and data. Intecom's IBX is one of several switches that share the attributes of the new-generation digital switch.

ance carriers [*Electronics*, Sept. 23, 1985, p. 14].

Direct broadcast satellite services—which some are calling the last opportunity to set a new broadcast standard for television—have weathered the wrath of politicians and regulators. At the mid-September meeting of the International Telecommunications Union, the developing and advanced countries agreed on a compromise measure that guarantees a geostationary slot for each developing country. Most of the reserved slots are in the so-called expansion bands, giving 800 MHz each for uplink and downlink.

The first allotment is in the 4-GHz downlink/6-GHz uplink, or C band, where technology is relatively inexpensive. Frequencies reserved for developing nations are from 4.5 to 4.8 GHz for the downlink and a yet-to-be-determined slice of 300-MHz bandwidth between 6.425 and 7.075 GHz for the uplink. Other reserved frequencies are in the 11/12- to 14-GHz, or K_u band, where 500-MHz slots are being held.

Satellite launch failures could scare off insurance carriers

Though DBS still has a way to go in terms of both regulatory issues and broadcast standards, the delivery technology is well in hand. Over the last few years, the equivalent isotropically radiated power (EIRP) of broadcast satellites has been increasing as a result of developments in higher-power traveling-wave tube amplifiers, larger solar arrays, and improvements in antenna designs. The trend is to even higher-power satellites and smaller receivers.

The first generation of geostationary satellites had EIRP so low the satellites needed 30-m-diameter receivers, but later improvements in C-band technology have made it possible for 4-GHz satellite receive-only stations to locate in a backyard or on the roof of the neighborhood bar and cost no more than a couple of thousand dollars.

With the maturity of C-band TV-receive-only transmission comes a problem. The technology was intended solely for cable head-ends, so homeowners picking off TV signals have become a significant threat to the market. Broadcasters are likely to follow the example of Home Box Office, which recently began scrambling transmissions. Among those with working scrambling and descrambling units are M/A-Com Telecommunications Division, Germantown, Md., which is supplying HBO.

The scrambling efforts arrive just ahead of further improvements in delivery. The launch late this year of K_u-band satellites, which operate at 12.2 to 12.7 GHz in the Western hemisphere, could lower the cost of a receiver to $1,000 and shrink its size to 1.2 m. And the next generation of birds under construction for 12-GHz broadcast satellite service may well perch a 0.6-m-diamater receiver on top of a TV at a cost comparable to that of a conventional TV system.

Advances in satellite and fiber networks will hasten the delivery of the ISDN. For semiconductor manufacturers already reeling from a worldwide slump, ISDN may be the promised land. But between the slump and the promised land lies the difficulty of implementing international standards.

ISDN will provide either circuit-switched, nonswitched, or packet-switched data in 64-kb/s increments on a clear channel. For the user of the ISDN network, the basic access has already been defined. The user will have an information pipe from the two-wire local loop to the network termination point at his premises. It will be two channels—64 kb/s each—for either data or voice, plus a signaling channel. The information channels are called B channels. The 16-kb/s signaling channel is called D.

The interface between the local loop and the customer-premises termination point is called U. The circuitry at the network termination point converts the U interface to two other interfaces: the ISDN-defined S and T interfaces. The S and T interfaces will transmit at twice the bit rate of the B channel plus the D channel—2B+D or 144 kb/s. The S and T interfaces link the customer's equipment to ISDN.

But the primary ISDN access for a PBX requires a higher bit rate. In North America, the format will be 23B+D—1.544 Mb/s; in Western Europe, it will be 30B+D—2.048 Mb/s.

The problem for semiconductor manufacturers is that they do not know yet whether the S/T or the U interface will be the basis for wide-scale implementation of ISDN. On the one hand, U will be tough to define because local-loop standards differ so much between countries. On the other hand, a large number of proprietary implementations of the S/T interface could ultimately slow ISDN development.

Vendors of private branch exchanges are more likely to forgo standards in favor of low-cost proprietary versions of the S/T interface. Already, a large number of new ISDN products has been introduced or announced by such companies as Advanced Micro Devices, National Semiconductor, Motorola, Intel, West Germany's Siemens, and Canada's Mitel Semiconductor. ☐

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PRODUCTS NEWSLETTER

CMOS BIT-SLICE PROCESSORS MATCH AMD'S BIPOLAR PARTS IN SPEED

Integrated Device Technology Inc. has squeezed bipolar speeds out of low-power CMOS for its new Microslice family of microprogrammable bit-slice chips. The Santa Clara, Calif., company's chips are plug-in replacements for Advanced Micro Devices Inc.'s industry-standard bipolar Am2900 family. All run at speeds equal to AMD's products, but the $12.00 39C01C 4-bit microprocessor slice uses a fifth the power of Am2901C. The $18.60 39C10B 12-bit sequencer uses a third the power of a 2910. The $24.80 IDT 49C410, a 16-bit sequencer which addresses 64-K of microcode, uses a third the power of Am2910A. IDT says the three products, which are all available now, are the first of 10 Microslice products. ☐

LSI LOGIC'S LATEST ARRAY PACKS 50,000 USABLE GATES

LSI Logic Corp. announced a CMOS gate array using 1.5-µm design rules that it hopes is dense and fast enough to keep customers from turning to its standard-cell competitors, most of which use 2-µm processes. Using a channelless architecture, the device has the equivalent of 50,000 usable gates out of a total of 129,000 and features gate delays as low as 1.1 ns. The array carries more than 500,000 transistors. ☐

DIGITAL TV CHIP ELIMINATES FLICKER, IMPROVES RESOLUTION

The latest digital TV chip from Intermetall GmbH uses a double-scan technique to cut down interlace flicker and line scrolling and improve screen resolution. The PSP2032 is an addition to the Digit 2000 chip set from Intermetall, in Freiburg, West Germany [*ElectronicsWeek*, April 29, 1985, p. 32]. In NTSC digital receivers having the PSP2032, each transmitted line is displayed twice, which means that the viewer sees about 900 lines, double the 450 that appear on the screen. Thus, instead of a structure with distinct lines, the viewer perceives a sharp, continuous display with greater detail. The PSP2032 packs about 50,000 transistor functions on a 40-mm^2 chip fabricated in 3-µm MOS technology. The two 2032s needed per TV set will cost less than $20. Volume production will begin next year. ☐

LINEAR TECHNOLOGY'S FAST COMPARATOR RUNS ON SINGLE 5-V SUPPLY

A single 5-V power supply is all that's needed to drive Linear Technology Corp.'s high-speed comparator; competing comparators require two supplies. The Milpitas, Calif., company claims the LT1016 is less prone to oscillation than are other TTL-compatible comparators because its output stage does not draw large amounts of current. The bipolar chip runs at 10 ns, suiting it for analog-to-digital converters and high-speed sampling circuits. In quantities of 100, the LT1016 sells for $3.50. ☐

EMULATORS FROM STEP ENGINEERING TARGET NEW TI BIT-SLICE CHIPS

Designers with their eyes on Texas Instruments Inc.'s new microprogrammable bit-slice microprocessors can look to Step Engineering for their in-circuit emulation needs. The Sunnyvale, Calif., company's EM888 emulator for TI's 74AS888 arithmetic-logic unit and the EM890 for the 74AS890 microsequencer team with Step Engineering's Step-27 development station to provide 64-bit-wide real-time in-circuit emulation. An emulator controller resident in the Step-27 allows a programmer to examine and modify registers and word stacks and view the internal changes in the 888 and 890 parts as they occur, which is particularly useful for debugging complex algorithms. Prices for the emulators start at $5,000. ☐

DIGITAL OSCILLOSCOPES RAISE PRICE/PERFORMANCE STAKES

NEW UNIT EQUALS OLDER MODELS IN PERFORMANCE, COSTS 20% LESS

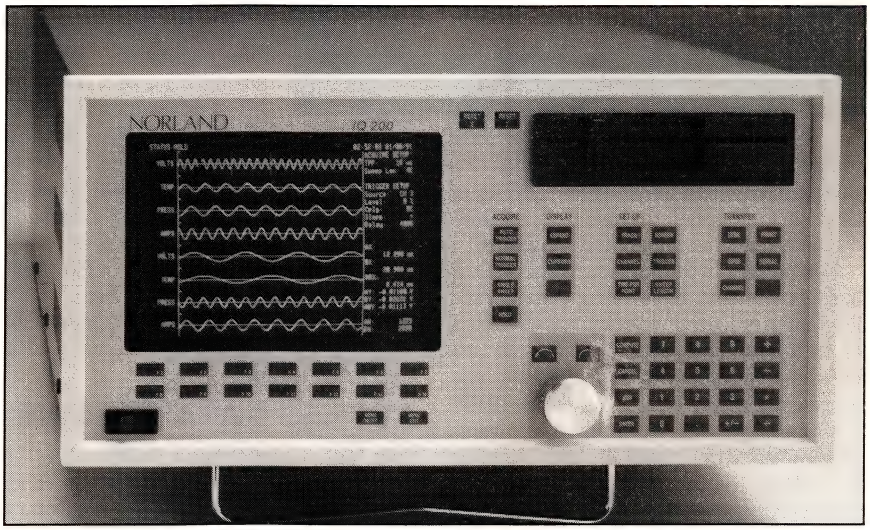
A new family of digital storage oscilloscopes promises a ground-breaking price/performance ratio. Both of Norland Corp.'s new scopes offer 50-MHz sampling rates and up to 16-K words of storage per channel.

Both scopes tap Motorola's 68000 to push performance beyond that of Norland's three-year-old 8085-based Prowler digital-scope line [*Electronics*, Sept. 8, 1982, p. 224]. Norland will continue to offer the Prowler as long as demand is there, says Mark Stradinger, product manager for Norland's waveform product line. But the new, two-channel IQ400, priced from $6,340 to $10,660, can offer comparable performance for about 20% less money, Stradinger says. Norland will offer an optional 68000-based fast-Fourier-transform board that will push the 8085-based IQ400 beyond the Prowler in time-domain processing and add frequency-domain analysis.

Robert Millar, Norland's national sales manager, credits falling component prices and increasing integration levels as key to the new scopes' aggressive pricing. On a price/performance basis, he contends the 40-lb benchtop IQ400 outclasses its nearest market competitor, the Data 6000 from Data Precision of Danvers, Mass. The $12,500 Data 6000 version has a 100-MHz bandwidth (achieved with two digitizers per channel vs. the IQ400's single digitizer). It has 8-bit resolution, whereas the IQ400 offers up to 12-bit resolution.

EIGHT FAST CHANNELS. The darling of the new family, though, may be the 80-lb rack-mountable IQ200. The IQ200 goes beyond digital-scope competitors, says Millar, by handling data acquisition on eight channels simultaneously, each at sampling rates up to 50 MHz. Most competing units offer a maximum of four simultaneous channels at those speeds, he says.

What's more, Millar adds, the 68000-based IQ200 mainframe is also the only digital scope that features a built-in 5¼-in. floppy-disk drive with a format compatible with the IBM Corp. Personal Computer disk format. Millar says the ability to read IBM PC floppy disks will ease the job of engineers at remote locations who, for example, might want to send data captured with the IQ200 to another facility for further processing. Like other digital scopes, the IQ200 has IEEE-488 and RS-232-C interface ports for transferring data to a computer.



EIGHT TIMES. Norland's new IQ200 scope can accept 8 channels of data coming in at 50 MHz.

Aimed at users with in-house IBM PCs or compatibles, the IQ200 is currently only a data-acquisition scope. Despite Norland's reference to the family as a line of digital-processing scopes, the IQ200 is not now offered with the data-analysis options available for the IQ400. But Norland expects to add processing options for the IQ200 later.

In addition the 68000-based FFT option, users can outfit the IQ400 with an 8087 math coprocessor to work with the IQ400's 8085. This can reduce the time required to perform certain trigonometric functions on 16-K bytes of data from 90 s to about 10 s.

IQ200 prices are set at $8,500 for a basic mainframe, with additional per-channel prices ranging from $1,250 for a low-speed 100-kHz channel with 12 bits of resolution and 4-K words of data memory per channel, to $3,750 for an 8-bit-resolution channel with 16-K bytes of memory that samples at 50 MHz. The smarter IQ400 can accommodate the same channel options for simultaneous data acquisition, but is equipped for a maximum of only two channels. Both scopes can be delivered 60 days after receipt of order. *–Wesley R. Iversen*

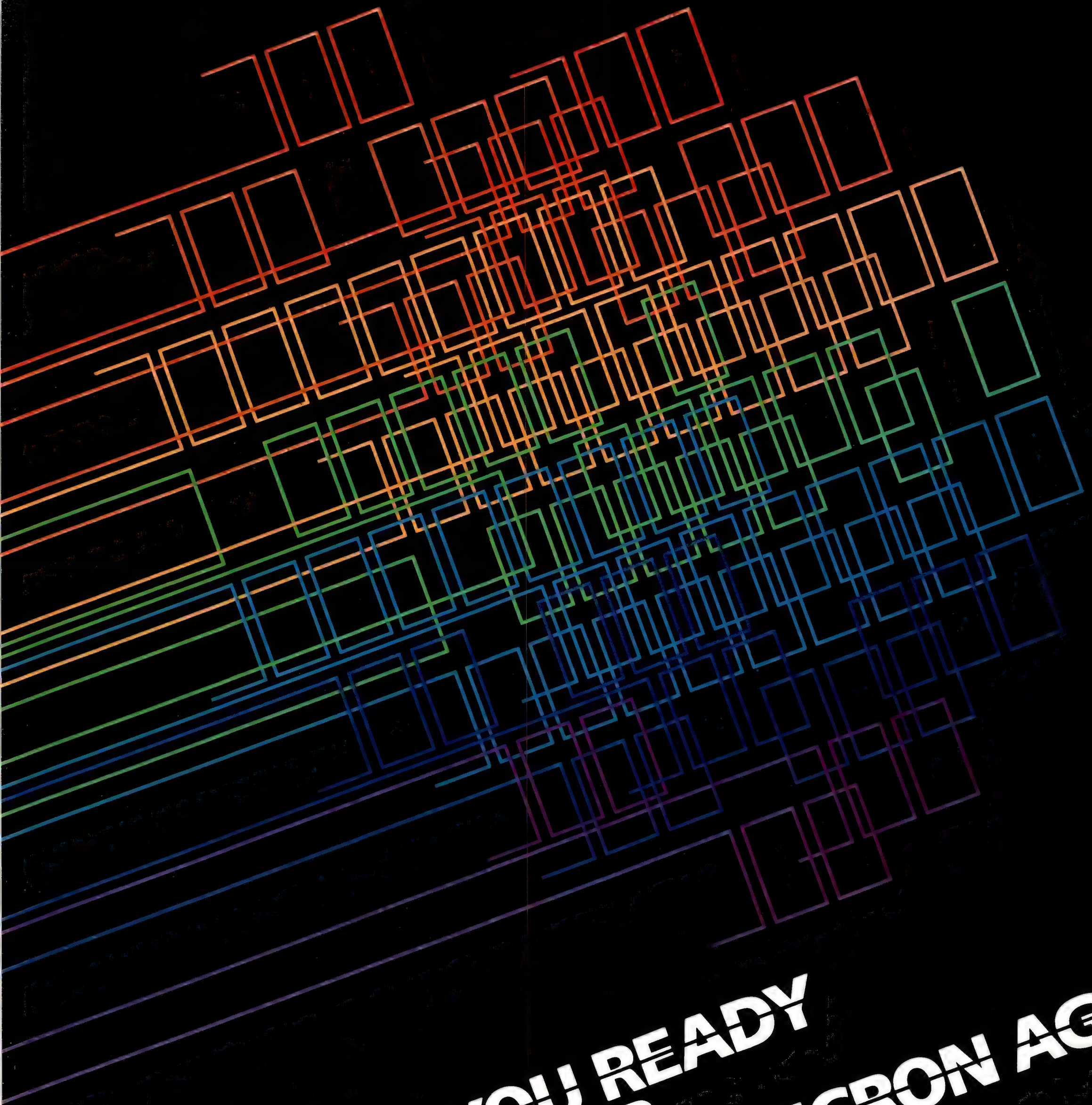
Norland Corp., Norland Dr., Fort Atkinson, Wis. 53538. Phone (414) 563-8456 [Circle reader service number 338]

DELAY-LINE IC GIVES HYBRIDS THE BOOT

Another hybrid component is being challenged by IC technology. A new monolithic CMOS chip from Dallas Semiconductor Corp. markedly improves on the performance of hand-assembled, bipolar-based delay-line circuits.

The DS1000 series of silicon delay lines replaces a collection of components and a Schottky logic chip with a single 2.5-μm CMOS circuit measuring 7,500 mil^2. "We think this is the first significant progress in the delay-line area in almost 20 years," says Michael Bolan, marketing director of Dallas Semiconductor. There are three or four delay-line components in every personal computer, coordinating timing of data in main memory and disk drives. Delay lines are also found in such high-performance gear as streaming-tape drives.

The laser-set delays of the silicon chips remain constant over a range of temperatures. A 100-ns delay, for example, will not drift more than a couple of



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INTEGRATED CIRCUITS

SIGNAL CONVERTER CONTROLS HP-IL NET

The NSC851 chip is a signal converter that performs network control between a microprocessor data bus and a Hewlett-Packard Interface Loop (HP-IL). The HP-IL is a two-wire, medium-range local-area network. The NSC851 appears to the microprocessor as eight memory or I/O locations. Reading or writing data in these registers controls action on the loop. The chip handles bit coding, serial-to-parallel conversion, and the time-critical aspects of the HP-IL protocol. Available now in a DIP, the NSC851 sells for $12 in lots of 100 and up.

National Semiconductor Corp., 2900 Semiconductor Dr., Santa Clara, Calif. 95051.
Phone (408) 721-5000 [Circle 350]

FAIRCHILD UNVEILS CMOS LOGIC FAMILY

Fairchild's new family of advanced CMOS logic circuits exceeds the performance of standard Schottky, advanced low-power Schottky, and high-performance CMOS devices. Called Fact (for Fairchild Advanced CMOS Technology), the line will initially consist of 80 of the widely used 54 and 74 series logic circuits, including flip-flops, octal buffers/line drivers, and octal transparent latches. Samples are available now.

Power consumption is as low as 0.1 mW/gate at a 1-MHz clock frequency, with propagation delays of only 5 ns. All gates in the Fact parts, which are fabricated in a sub-2-μm silicon-gate CMOS process, can handle very high overload source and sink currents of 100 mA without latchup. Prices range from 33¢ to $1.47 each in lots of 100.

Fairchild Camera & Instrument Corp., 464 Ellis St., Drawer No. 7281, Mountain View, Calif. 94039.
Phone (415) 962-5011 [Circle 351]

IC POLICES SYSTEM'S COMMUNICATION

The SCN68562 dual universal serial communicator controller (DUSCC) mediates communications among computers and peripherals in systems organized around the 68000 processor. It does so with minimum intervention from the processor, the company says, performing system-memory management and protocol-specific tasks.

The DUSCC features multiprotocol operation, programmable bit rate, data-transfer rate between 0 and 4 MHz, interrupt capabilities that include daisy chaining and vector output, and TTL compatibility. The operating mode and data format of each channel can be pro-

1	Exxon	26	AT&T Technologies	51	Georgia-Pacific	76
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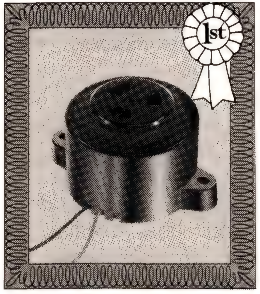

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COMPONENTS

DUAL, QUAD SWITCHES TARGET VIDEO MARKET

The dual IH5341 and quad IH5352 monolithic CMOS analog switches are designed for switching radio-frequency and video signals. Their series-shunt-series switch structure provides 70 dB guaranteed off-isolation at 10 MHz and over 70 dB of cross-coupling rejection at 10 MHz. The channel on-resistance of 50 Ω provides excellent matching to video impedances.

The switches' respective turn-off and turn-on times are 160 and 70 ns, suiting them for break-before-make switching in multiplexed circuits. The quiescent supply current of 100 nA limits the quiescent power dissipation to 3 μW, making the IH5341 and IH5352 suitable for portable and battery-powered equipment. The switches operate from ±5- to ±15-V power supplies.

The IH5341 is available in a 14-pin plastic DIP, a 14-pin Cerdip, or a 10-pin TO-100 metal can, priced from $3.95 for the commercial grade to $8.90 for the military temperature range. The IH5352 is available in a 16-pin plastic DIP or a 16-pin Cerdip housing. Its prices are $7.75 for commercial, $9.70 for industrial, and $15.50 for military grades. All prices are for quantities of 100, which are filled from stock.

Maxim Integrated Products, 510 N. Pastoria Ave., Sunnyvale, Calif. 94086.
Phone (408) 737-7600 [Circle 356]

ANALOG SWITCHES TURN ON QUICKLY

The DG5140 family of analog switches feature low on-resistance (30 Ω is typical), 150-ns turn-on time and 125-ns turn-off time, and break-before-make switching for single-pole double-throw designs. Power consumption is less than 35 μW at 25°C. The switches' low power-supply requirement of 1 μA maximum makes them suitable for battery-powered industrial applications, such as in programmable controllers.

The CMOS switches use a high-voltage silicon-gate process that features 44-V maximum rating; this allows conservative design ratings with ±15-V supplies. An epitaxial layer eliminates latchup. All the popular switching patterns are available in this family, in both single- and dual-switch packages, including 16-pin ceramic and plastic DIPs.

Samples are in stock, and production quantities will be shipped in six weeks. For 100-piece quantities, prices range from $4.06 to $20.70 each.

Siliconix Inc., 2201 Laurelwood Rd., Santa Clara, Calif. 95054.
Phone (408) 988-8000 [Circle 353]

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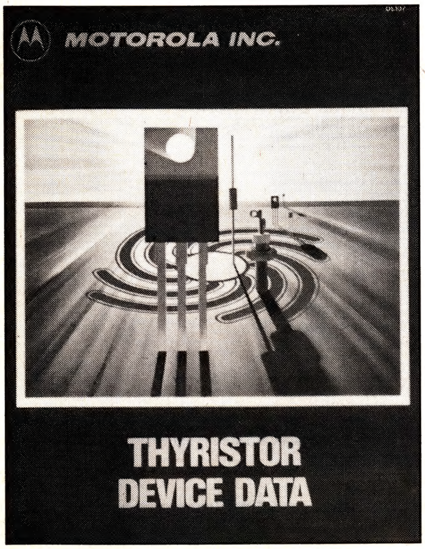
NEW LITERATURE

ANALOG PROCESSOR. A four-page data sheet, free from Measurex Corp., describes the Vision 2002 network's low-level analog input processor. The data sheet describes the processor's main features, including 16 low-level analog signals that can be brought into the Vision 2002 network without signal conditioning, and two sets of 120 trend-memory data points for each input. Vision 2002 is a computer-integrated-manufacturing network. For a copy of the data sheet, call Measurex at (408) 255-1500 or write to the company at 1 Results Way, Cupertino, Calif. 95014. [Circle 424]

DISPLAY STATIONS. IBM Corp. is offering a free brochure that describes its model 3161 and 3163 ASCII terminals, which connect to both IBM and non-IBM host computers. The family includes four models and eight different emulations of a number of popular terminals, including the IBM 3101 model 881 and Digital Equipment Corp.'s VT100 and VT52. The monitors tilt and swivel, and the model 3163 offers a keyboard with redefinable and recappable keys for custom configurations. To obtain a copy of the brochure, contact IBM Corp., Communications Products Division, Dept. 801, 44 S. Broadway, White Plains, N. Y. 10601. [Circle 425]

THYRISTORS. The *Thyristor Handbook*, 600 pages long, contains information on silicon-controlled rectifiers, triacs, gate turn-offs, and drivers and thyristor triggers. The handbook covers symbols and terminology as well as the theory of operation, reliability, and quality. Use of the thyristor die for hybrid assembly is described, as well as mounting techniques. The handbook, literature DL137, is free from Motorola sales offices and distributors; for further information, call Motorola Semiconductor Products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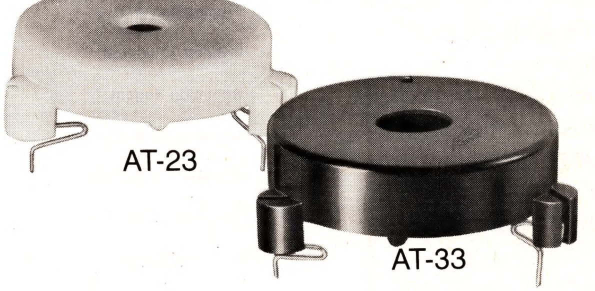

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NEW LITERATURE

Inc. at (602) 244-4561 or write to P. O. Box 20912, Phoenix, Ariz. 85036.
[Circle 426]

VLSI TESTING. How to calculate the total ownership cost of a very large-scale-integration test system is covered in a free booklet titled "The Economics of VLSI Testing" from Teradyne Inc. The booklet uses the J941 test system as the example, and model work sheets guide users and manufacturers through comparisons with other test systems. The booklet addresses three interrelated testing issues: quality, startup and programming time, and cost control. Request a copy of the booklet by writing to Teradyne Inc., Inquiry Systems and Analysis, 660 Summer St., Building 114, Box 120, Boston, Mass. 02210.
[Circle 427]

CABINETS. Catalog no. 170-85, free from Equipto Electronics Corp., describes a line of heavy-duty modular electronic cabinets. Designs include vertical-rack and sloped-front consoles that offer shielding against electromagnetic and radio-frequency interference. The catalog's photos and drawings detail assembly and mounting details and other design features. Most of the company's cabinets are offered in both stock and custom sizes. Call (312) 897-4691 for a copy of the catalog, or write to the company at 351 Woodlawn Ave., Aurora, Ill. 60506.
[Circle 428]

RESISTORS. A free short-form catalog describing resistive networks, trimming potentiometers, and resistor chips for hybrid manufacturing comes from Vishay Resistive Systems Group. Bulk Metal foil precision resistors, the company's proprietary design, resist both heat and moisture and offer load-life stability in such applications as communications and instrumentation. Ask for literature number SF500B from the company's Marketing Communications Department, 63 Lincoln Hwy., Malvern, Pa. 19355, or call (215) 644-1300. [Circle 429]

MULTIPLIERS. A short-form catalog from Weitek Corp. gives an overview of very large-scale-integration 16 by 16-bit multipliers and multiplier-accumulators; 32-bit and 64-bit floating-point multipliers and arithmetic logic units; two 32-by-32-bit n-MOS six-port register files; a transformation processor for Multibus I systems; and a solids-modeling engine for the IBM Corp. Personal Computer AT that generates vector graphics at the rate of 60,000 shaded pixels/s. The literature is free from the company at 1060 E. Arques Ave., Sunnyvale, Calif. 94086, or call (408) 738-8400.
[Circle 431]

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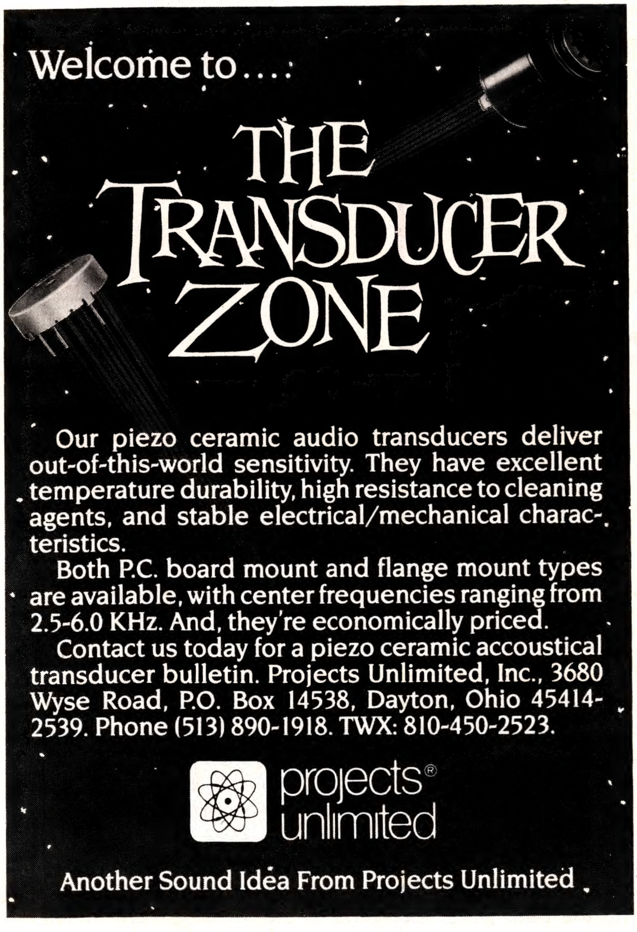

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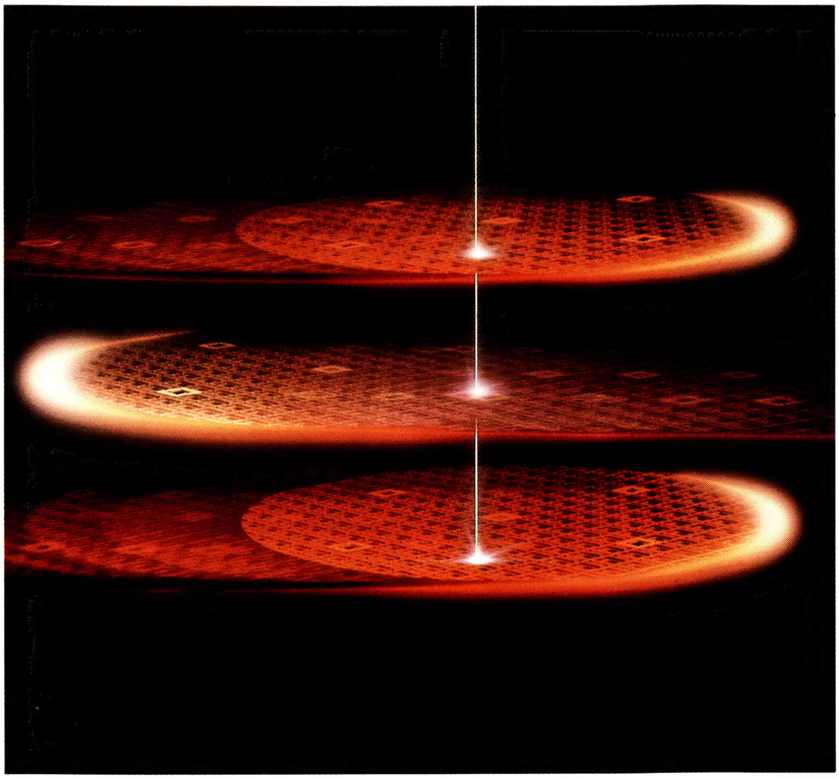

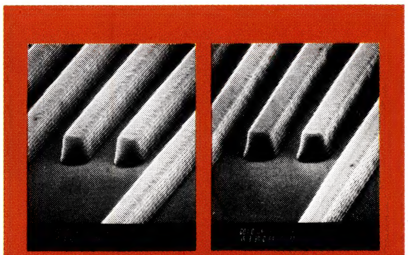

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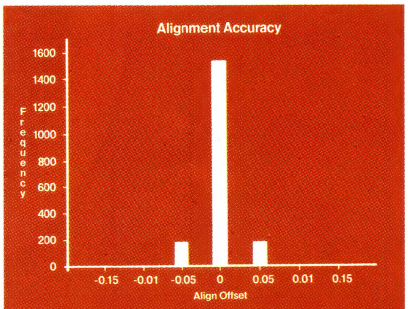

Histogram illustrating field-by-field alignment accuracy of 8 consecutively manufactured SRA 5X systems.

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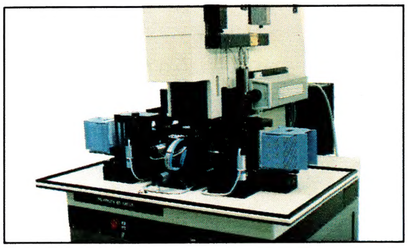

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